DYNAMIC SOCIOLOGY,

OR

APPLIED SOCIAL SCIENCE,

AS BASED UPON

STATICAL SOCIOLOGY AND THE LESS COMPLEX SCIENCES.

BY

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"Τί διαφέρει μανίας ἀμαθία;"—SOCRATES.

IN TWO VOLUMES.

VOLUME I.

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TO

MAJOR POWELL,

EXPLORER, GEOLOGIST, ANTHROPOLOGIST, AND PHILOSOPHER,

WHOSE GENEROUS AID,

WARM WORDS OF ENCOURAGEMENT, AND FRIENDLY INTERCOURSE

HAVE SUSTAINED ME IN MY PROLONGED EFFORT,

THIS WORK IS GRATEFULLY

Dedicated.

PREFACE.

A GROWING sense of the essential sterility of all that has thus far been done in the domain of social science has furnished the chief incentive to the preparation of this work.

While this sterility is certainly very manifest in the superficial and unorganized labors of those who especially claim that field as their own, still it is not wholly or chiefly such that are open to this impeachment, but also and equally the quite opposite class, who indeed employ scientific methods in obtaining the true data of social science, but who not only fail to apply the data when obtained, but persist in teaching that no application of them can be made. Not that the results attained by either of these classes are without value; they have a great and permanent value, but it is thus far potential only, and can not be converted into actual value until truer views shall prevail respecting the nature of social phenomena and social forces.

Just as Comte could complain that the philosophy of Hobbes, Locke, and Voltaire was negative, so it may now be maintained that the school of Mill, Spencer, and Fiske is also negative. From the purely statical stage of the former the latter has only advanced to the passively dynamic stage, which recognizes only the changes wrought by Nature, unaided by Art; but, before the science of society can be truly founded, another advance must be made, and the actively dynamic stage reached, in which social phenomena shall be contemplated as capable of intelligent control by society itself in its own interest.

The indictment of sterility has lain against all the great systems of thought. Theo-teleology is sterile, because, however viewed, it paralyzes effort (vol. ii, pp. 38, 301); metaphysical ontology is sterile because it ignores the mediation of material things and builds on pure ideas; and now even the philosophy of evolution thus far proves sterile also, because, while justly claiming a social science, it falls short of admitting its complete homology with other sciences, and, while demonstrating the uniformity of social as of physical phenomena, it denies to the former that susceptibility to artificial modification which, applied to the latter, constitutes the only practical value that science has for man.

Perhaps it is more correct to say that the new school fail to comprehend the true nature of *art* as applicable to all departments of science. Perceiving that natural processes are genetic, they erroneously conclude that Nature's ways should be man's ways. They thus confound the essential idea of fine art with that of useful art, the imitation of Nature with the control of Nature. They teach the natural as the proper human method, whereas the latter is necessarily an artificial method.

Sociology is reproached, even by those who admit its legitimacy, with being impracticable and fruitless. The prevailing methods of treating it, including those employed by its highest living advocates, to a great extent justify this charge. There are dead sciences as well as dead languages. The real object of science is to benefit man. A science which fails to do this, however agreeable its study, is lifeless. Sociology, which of all sciences should benefit man most, is in danger of falling into the class of polite amusements, or dead sciences. It is the object of this work to point out a method by which the breath of life may be breathed into its nostrils.

It has been found sufficiently difficult in any age to contribute any thing new to the thought of the world. In the present age, with its accumulations of learning and its intense intellectual activity, such an attempt would, indeed, be presumptuous. Henceforth it can be only in the direction of improved methods, and new forms of presenting old truths, that novelty and successful innovation, in any but the domain of original scientific research, are to be expected. The only positive claim here made is of this nature—that while the world's present stock of known truth, the generous tribute of many great minds, has been freely but appreciatively employed, it has been woven into a unique fabric, and one by which, to continue the figure, society may be completely rehabilitated.

If, in the detailed unfolding of this system, any comprehensive principles have been announced, to which attention has not heretofore been specially directed, the chief of these will, perhaps, be recognized in—

1. The law of Aggregation, as distinguished from that of Evolution proper.

2. The theory of the Social Forces, and the funda-

mental antithesis which they imply between Feeling and Function.

3. The contrast between these true Social Forces and the guiding influence of the Intellect, embodying the application of the Indirect Method of Conation and the essential nature of Invention, of Art, and of Dynamic Action.

4. The superiority of Artificial, or Teleological, Processes over Natural, or Genetic, Processes; and, finally—

5. The recognition and demonstration of the paramount necessity for the equal and universal Distribution of the extant Knowledge of the world, which last is the crown of the system itself.

While there certainly have been adumbrations of many of these truths, it is believed that thus far no one of them has been systematically formulated or distinctly recognized.

It is acknowledged that many of the important generalizations made in this work are left unsupported by much necessary illustration which was at hand for the purpose. Such omission has, of course, been intentional, in consequence of the amount of space which these examples would occupy. Indeed, the most difficult part of the task has been that of compressing so large a subject into reasonable limits. For it has been truly said that it is easier to write a volume than an essay; but here the entire treatise practically assumes the character of an essay, involving the increased labor of condensation. Kant not too modestly excuses this lack of popular illustration, in his "Kritik der reinen Vernunft," by quoting the remark of the Abbé Terrasson, that, "if the size of a book is to be measured, not by the number of leaves, but by the time required to understand it, it could be said of many a treatise that it would be much shorter if it were not so short." Yet, after all, the work to many will, I fear, seem large. To such it can only be answered that the theme is also large, and its size may perhaps find a partial justification in the words of M. Littré, applied to a much larger as well as greater work—the "Philosophie Positive":

"Il n'est point de grande doctrine sans grand livre."

L. F. W.

WASHINGTON, *January 20, 1883.*

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It would be to neglect a plain duty should I fail to acknowledge the assistance which I have received from a few friends to whom the nature of my undertaking has been made known.

To Professor William B. Owen, of the Faculty of Lafayette College, I am indebted for a permanent interest in the work dating back to a time when it was as yet in embryo; and, as it progressed, it was to him alone that I felt confidence in announcing each step, and in applying for advice and encouragement. It is to his ripe scholarship, and always moderate counsels, that much of whatever literary finish or conservatism in tone the work possesses is due.

When the work of publication commenced, I found myself doubly fortunate in securing the invaluable aid of two gentlemen—Mr. Edward T. Peters and Dr. Frank Baker—well informed upon the subjects discussed and well disposed toward the work, who volunteered to look over the proofs, and who, as a pure labor of love, have persisted in this service to the end. As a practical economic writer and thoughtful student of society, Mr. Peters was able to offer many useful suggestions which have greatly enhanced the value of the discussion of social questions.

As an accomplished physiologist, Dr. Baker has given to the topics within his profession an advanced position and a degree of accuracy otherwise unattainable.

My thanks are also due to Mr. David Hutcheson, of the Library of Congress, for much valuable assistance as an accomplished bibliographer in finding many rare works which it was essential to consult, and also in critically revising the list of books to which references are made. The completeness and efficiency of this important department are in great measure due to his voluntary services.

All this is independent of my great debt to Major J. W. Powell, for which the poor boon of a dedication seems a trivial acknowledgment; and also of my lasting obligation to Professor Edward L. Youmans, who has been especially helpful to me in facilitating publication.

L. F. W.

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INTRODUCTION.

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The science of Sociology, in so far as it can be said to have had a definite origin, was founded by Auguste Comte, who first made use of the term in his "Cours de Philosophie Positive," vol. iv, p. 185, third edition, written in 1838. The conceptions on which it rests, however, are much older, and Comte himself ascribes their first distinct enunciation to Montesquieu and Condorcet.

The essential element in the idea of a social science is, of course, the recognition of the regularity and uniformity of social phenomena. Statistics had proved this with respect to certain classes of these phenomena, and there had been many before Comte who had not shrunk from declaring that the apparent irregularity and arbitrary nature of human actions and social movements were due to the greater complexity of this class of facts, and the consequent inability of man to reduce them to general laws.

But Comte undertook another and equally important task. He sought to fix the position of sociology among the sciences, of which he drew up a natural series or "hierarchy." This was, in fact, an attempt in the most general way to classify the sciences. In this he proved himself a true philosopher.

The classification of the sciences is and should properly be made the basis of every comprehensive scheme of philosophy. Everything that can be known belongs to science. Everything capable of forming a distinct intellectual conception is reducible to a place under some one of the scientific categories. Indeed, science itself, in so far as it is distinguishable from knowledge in a general sense, consists in a co-ordination and subordination of the different kinds of knowledge; in a word, the essential of all science is the classification of knowledge. The classification of the sciences, therefore, is itself strictly a science, and consists in a prolongation of the scientific process, whereby it is extended into higher fields and made to embrace its own grand divisions, objectively regarded as material for science. Mere classification, or "systematization,"* is, therefore, a less trivial operation than some persons have intimated. It is the essential process of organization, and has for its real object to arrive at the true *order* which exists in the universe. But order implies a relation of parts, not an ideal but a real relation. The only real or physical relation which can subsist is the relation of dependence, or subordination, by which every thing is actually connected with every thing else, both in space and time, by an unbroken series of links. Relation of co-existence is an ideal relation which can only be realized by following both objects back through their

* J. S. Mill, "Auguste Comte and Positivism," Philadelphia, 1866, p. 177.

chain of real relations to their common antecedent. This ideal relation of co-existence, or independent existence, is the domain of fact, and constitutes the field over which the specialists, the mere fact-gatherers, delight to roam, and in which they perform their vast and invaluable labors. But, on the other hand, the relation of sequence, of dependent existence, is the domain of law, of order, and the fertile field in which the great systemizers, theorizers, and organizers of the world find congenial employment. It is the former class with whom the term science is, at the present day, most commonly connected, that of philosophy being generally reserved for the labors of the latter class.

Without discussing the relative merits of either of these terms, or of the classes of labor to which they are applied, the incorrectness, not to say injustice, of withholding the title of science from the efforts of those whose minds are ever seeking after the order of the world rather than its disconnected materials, is too apparent to need be more than pointed out.* It is clear that the possession of materials of science is only of practical value to mankind in proportion as they are co-ordinated and organized, and it has been justly remarked that such an accumulation in excess of one's powers to systemize, may constitute an impediment to progress from the very confusion which it engenders.

All classification is a striving after unity. To classify it is necessary to generalize. The only exception possible would be where all the terms are co-ordinate, a condition

* It is an unfortunate circumstance that the speculating and philosophizing have, to a great extent, been done by persons who have not been observers of facts, while those who have extensively observed have either not found time to theorize, or have shrunk timidly from the task of drawing conclusions. Alexander von Humboldt, while he complained of this tendency, was himself an example of it. The question now is, not whether men shall cease to philosophize, for this, as Sir William Hamilton says, can not be prevented, but whether philosophy and speculation shall be forbidden to those who have premises, and, consequently, monopolized by those who have none. Shall science and philosophy, thought and things, be united or divorced?

which is never found in nature. Generalization rises from the individual and special to the general and universal. Within certain limitations the universal is frequently reached, and, in such cases, unity is attained. But such unity is only relative. However many such unities there may be, and however apparently independent and co-ordinate they may be, they are all subordinate to some higher unity, and so on until we arrive at the ultimate unit which comprehends, or rather constitutes, the universe itself, and whose limit is infinity. This must, therefore, ever remain incomprehensible to the finite. Every approach toward it, however, furnishes a high satisfaction to the human mind, and can not fail to place the race not only upon a higher intellectual but upon a higher material plane. As a sufficient illustration of this we need only point to the great barological law of Newton, which, though by no means an ultimate unit, has raised both the intellectual and the material world to a new and higher stage of existence and activity.

The efforts of modern philosophers to classify the sciences have, on this principle, exerted a wholesome influence upon human speculation. They have done more. They have added a new impetus and given a certain tone to science itself. The pursuit of knowledge, in whatever manner, is necessarily laborious. No labor can be performed without a stimulus or incentive. The first principle of political economy is that every one must be expected to seek the greatest gain. But gains are of various kinds. The mind has its needs and its satisfactions as well as the body. Intellectual labor usually receives its remuneration *in kind.* Where no immediate material benefit is to follow, the mind can not be depended upon to labor except for a confidently expected reward in intellectual satisfaction. It is this anticipated intellectual remuneration that has formed the incentive to the greatest mental achievements. It is to this that we owe our grandest discoveries. To one class of minds, it must be admitted, a seemingly adequate satisfaction is felt in the mere acquirement of independent items of knowledge. It would probably be more correct to say that the natural satisfaction which the mind normally derives from the acquisition of knowledge is sufficient in some persons to render it more or less independent of the quality of that knowledge. This sentiment exists in all just as the sense of causalty exists in all, only in some, under certain conditions of education or of inherited experience, the passion for acquisition predominates and, as it were, eclipses the satisfaction derived from the contemplation of causal relation, so that the former alone may become a sufficient stimulus for a life of arduous labor. The case is analogous if not parallel to the trite one in which the passion for the acquisition of wealth becomes an incentive in itself to the complete oblivion of the real purpose or utility of the wealth amassed. For, on the one hand, the materials of science, like those of wealth thus acquired, may or may not be somewhat useful to the individual accumulating them, but are pretty sure to be ultimately useful to others; so, on the other hand, the real value of the former consists in their employment, by those competent to do so, for the discovery of the laws of nature by a study of their natural relationships; a use as unlike that to which their collector applies them as the economic distribution and circulation of money is unlike its systematic hoarding in the vaults of the miser. But this class of scientists who derive an adequate remuneration for their sustained labors in the pleasure which each new object affords, independently of its relations to other objects, and of its place in the great hierarchy of nature—this class, though large and useful, can be progressive only in an indirect manner, and only as the *statisticians* of that other class, in whom the supreme gratification consists in tracing the relations of dependency among the objects of nature and assigning each to its appropriate group in a universal system.

The primary task of this latter class was the establishment of science itself, for which the other class now receives the chief credit. Science, as before remarked, is the co-ordination, or, rather, the systemization of knowledge. It is this causal type of mind which, not satisfied with a heterogeneous mass of known facts and phenomena, each appealing independently and for itself to the intellect, has proceeded to organize this mass and determine the relations of its individual facts and phenomena to one another, thus endeavoring to reduce all knowledge to a homogeneous system. This ideal homogeneous system is science. In the attempt to reach it many distinct steps have been taken, many comprehensive groups have been clearly established. Each of these groups is denominated *a* science. In the present infancy of the co-ordinating process it is not surprising that these so-called sciences should have themselves the form of units, of independent groups of knowledge. So little is known of the more remote and involved relations of phenomena, that when a phenomenon has been correctly referred to a given group it is not suspected that it possesses other than those most obvious relations which induced such a reference. So distinct appear the sums of these related phenomena, these groups called sciences, that it is not perceived that they have further relationships, indirectly with one another, but directly with a higher order of phenomena to which they have a common relation of dependence. Thus, after the great step which has resulted in a multitude of independent sciences, out of a multitude of independent facts, the world is now preparing, under the leadership of the causal type of mind, to take another great step and bring this heterogeneous multitude of apparently independent sciences into one homogeneous system of universal science. As no one will deny that the establishment of the present so-called sciences was a great advance upon the conception of an infinite multitude of independent facts, so we have a right to expect that the universal science or true cosmology will constitute an equally great advance upon the present heterogeneous state of science.

Now, the means by which each of the present established sciences has been reached is the *hypothesis*. It is to the theorizers, to those who, not knowing the relations of things, *suppose* them and proceed upon their suppositions, and, if false, reject them and try other suppositions, until they arrive at the true laws of phenomena, that the world is almost exclusively indebted for what it now possesses of organized science. It is the so-called philosophers who after all lead the scientific as they have always led the intellectual and literary world. It may not be too much to say that science will one day admit that it owes more to Immanuel Kant for publishing his "Theorie des Himmels" than to Alexander von Humboldt for publishing his "Cosmos"; the one a brief but profound theory of the Cosmos, the other an extended enumeration of its then known phenomena.

There are two principal directions in which this work of unifying science is advancing: the one is the discovery of comprehensive laws under which great groups of distantly related phenomena can be systematically placed; the other is the establishment of a hierarchy * of the sciences. These two paths of progress are somewhat distinct, though ultimately dependent. In any given state of discovery and of knowledge, the work of organization can be carried on independently of new discoveries until its materials are exhausted. On the other hand, the work of discovery can be carried on to a great extent independently of the organization of previously known facts. Such has, in fact, been the true history of science. The discoverers of great principles have never themselves been able to refer but a small number of the facts properly belonging to them to those principles. They have generally "builded better than they

* The use here of the word *hierarchy* in the Comtean sense, from the analogy of the *Celestial Hierarchy*, and upon which ecclesiastical rank in the Roman and Anglican churches was based, is not for the sake of novelty, but because it seems to supply a positive defect in the language.

knew." Strictly speaking, only three comprehensive cosmical principles have yet been enunciated, only one of which is yet universally accepted. These are: 1, the law of gravitation; 2, the nebular hypothesis; and, 3, the development theory. The attempt of Herbert Spencer to combine the two latter in connection with the first into a universal theory of evolution approaches nearer to the complete unification of science than has ever before been done. In fact, the idea embraced in the word evolution * as employed by him is by far the nearest approach ever yet made to the conception of an absolutely universal and cosmical law. Among the next great steps to be taken may be expected discoveries tending to explain more fully the nature of the matter of interplanetary space, and thus perfect our knowledge of the phenomena of light, heat, electricity, etc. It is possible that facts enough may now exist from which, if properly co-ordinated, some grand law of their common nature might be deduced. The world is probably now on the eve of one or more such far-reaching discoveries.

In the direction of organizing the known science the present epoch is very active. Two important principles of classification are now for the first time recognized and avowed. The one is that of a *causal dependence* in all the phenomena of nature ("monism"). The other is that of the *utilitarian object* of science.

The leading scientists and philosophers now realize and announce that all possible observable phenomena have real antecedents, and that therefore the work of investigating them is no longer a hopeless task, as it certainly would be if the possibility of the absolute independence of any phenomenon were admitted.

The leading thinkers of our time also now concede and declare that the only ultimate object which can be successfully maintained for human effort is the improvement of the human race upon this planet.

* For a criticism of this term as employed by Mr. Spencer, see *infra*, p. 248.

Under the healthy stimulus of these two cardinal principles, the work of organizing human knowledge is now progressing with great promise of soon reaching a high state of completeness. Not until the work of classifying the sciences could be undertaken with the clear recognition that they may be arranged in some sort of connected and ascending series, whereby an acquaintance with subordinate stages becomes essential to a complete appreciation of the higher ones, could any satisfactory arrangement of the groups of phenomena be made or expected.

Not until such a clew was discovered and laid hold of, as the purpose of elevating humanity furnishes, could sufficient energy or perseverance be infused into the effort to insure for it a successful issue. The conception of a universal causal dependence of phenomena when transformed into an active working principle takes the shape of a universal theory of development or evolution. The high utilitarian motive, focalizing all considerations in the good of man, can have no other effect than to establish as the ultimate science, for the perfection of which all other sciences exist, the science of human life, which takes the form and name of sociology.

Thus, with the principle of evolution as a law and guide, and with the doctrine of "meliorism" (vol. ii, p. 468) as an incentive and motive-power, the organization of all facts, forces, and phenomena into an orderly and connected system is to-day progressing with certain and rapid steps.

The subject of the classification of the sciences and of the natural order of phenomena will come up for a more special consideration in an early part of the work (*infra*, pp. 97, 147, and chaps. iii–vii). Its introduction here is for the purpose of early calling attention to the position and to the importance of sociology in such a system. Whatever may be the difficulty in fixing the position of any other science, that of sociology, as Comte clearly showed, must occupy the last place in the series. Its highly special character, its great complexity, and, above all, the dependence which a careful study of it shows it to have upon all the rest, all point unmistakably to the end of the chain as its only natural position. Not only does it depend more or less upon all other sciences, but it can not be shown that any other science is in the least dependent upon it. This last fact is even more decisive than the others as to its true character and place. Its logical position at the end of the series is further shown by the manner in which it comprehends all other sciences. It is, as it were, all sciences combined, embracing all that they embrace, together with a large *differentia.*

It is impossible, on the other hand, to overestimate the importance of a well-defined object toward which human effort may be directed.

It is vain to expect men to put forth efforts unless some object is clearly set before them. It is further necessary that this object be a positive or constructive, and not a negative or destructive one. The tendency is to be perpetually building up. Negative objects, whose nature is to tear down, are undertaken with reluctance, and soon relinquished. To insure successful prosecution they must possess the elements of progress, and give earnest of carrying the world forward to a more advanced position. The failure of all religious systems to accomplish this is now apparent to all capable of observing the history of the world from a wholly unbiased stand-point. The influence of imaginary advanced states beyond the present life has had no effect in securing such a state in this life.* The moral systems that have been more or less mechanically mixed with religious ones have shown themselves incapable of progressing beyond a limit reached in the time of Confucius and Hillel.†

* Tylor, "Primitive Culture" (Boston, 1874), vol. i, p. 495; vol. ii, pp. 104–107. Auguste Comte, "Philosophie Positive," vol. v, pp. 123, 124, 297–300, etc.

† Hillel taught this precept, "Do not unto others as thou wouldst not have

The need of some inspiring progressive principle for mankind to lay hold of, for the satisfaction of that fundamental sentiment which aspires to a better condition, is as strongly felt now as it was in the days of Plato or of Paul.

The motive of all action is feeling. All great movements in history are preceded and accompanied by strong feelings. And it is those persons whose feelings have been most violent that have exerted the greatest influence upon the tone and character of society. Purely intellectual feeling is never sufficient directly to sway the multitude. The historical example which furnishes the nearest approach to this is that of ancient Greece. But even of this we have, in the surviving literature of that age, a very inadequate and superficial criterion. The fact alone that feeling so far prevailed over intellect as to require the sacrifice of Socrates to its demands gives us a faint glimpse of the other unrecorded exactions which it must have made. Throughout all time past, the mass of mankind has been carried along by the power of sentiment. It has never been deeply moved, at least directly, by that of intellect. Hence we see that the psychical agencies that have stirred up mankind have been chiefly of a religious nature. Religion is the embodied and organized state of the emotions. It represents the combined forces of human feeling. The immense success with which religious reformers have met has been due to the almost irresistible power of their emotional nature, and never to their intellectual supremacy. That this is the normal state of the public mind I shall endeavor to establish in another place (vol. ii, pp. 111, 113, 123). What I desire to draw especial attention to here is the remarkable fact that not only has the world been thus far ruled by passion and not by intellect, but that the true rulers of the world have had to be, in order to win that distinction, not merely enthusiasts and fanatics, but, in the majority of cases, insane per-

others do unto thee; that is all the law, the rest is mere comment."—("Babyl. Talm. Shabb.," 31 *a*.)

sons, in a certain legitimate acceptation of that term. It is no longer a question among modern medical men that the remarkable actions of those men who have laid claims to divine inspiration and founded religious systems must be referred not only to a pathological but to an actually deranged condition of their minds.*

The strange truth thus comes up for our contemplation that, instead of having been guided and impelled by intellect and reason throughout all the years of history, we have been ruled and swayed by the magnetic passions of epileptics and monomaniacs.

But this startling fact only shows us the more forcibly that it is feeling and not intellect which is required to influence human action. Indeed, this proposition is capable not only of a logical and a pyschological, but of a truly physical, demonstration. Still, as it is somewhat obscure, it needs the aid of such an illustration as the above to bring it home to the mind. Those persons (and there are some very enlightened ones) who hope one day to see this state of society reversed, and who are looking forward to the time when intellect and reason shall assume control of society, dethroning passion and emotion, are doomed to disappointment, not only in their own time but for ever. Intellect is not an impelling but a directing force. Feeling alone can drive on the social train, whether for weal or woe.

This is one of the great facts which the sociologist, laying aside all personal bias and seeking only the real and the true, must clearly realize and frankly acknowledge, and which, having realized and acknowledged, he must respect by shaping his philosophical system to correspond with fact. Renouncing the hope of an intellectual rule, admitting the

* Du Bois-Reymond's address before the Scientific Lectures Association of Cologne, translated into "The Popular Science Monthly," vol. xiii, p. 388. Henry Maudsley, in "Fortnightly Review" for September, 1878, p. 382. See also Dr. Howden's paper before the Edinburgh Medico-Psychological Association, 1873, "On the Mental Condition of Epileptics in Relation to Religious Sentiment." Also, William B. Carpenter, F. R. S., "Mental Physiology," p. 312.

right of feeling, or, if he please, of passion, to control the world, it becomes his duty to address himself to the only task remaining, and to inquire candidly how, taking facts as they are, the existing condition of society is to be ameliorated.

All reform which it is hoped to bring about by argument, persuasion, or any of the means available to the philosopher, must hold forth moral rather than intellectual inducements. To succeed, it must follow in the path of all previous efforts of the kind, of the religious systems and the moral schemes of Menu, Zoroaster, Confucius, Jesus, and Mohammed. But like these great and successful systems it must be in accord with the state of society upon which it is expected to exert an influence. Any one of those systems, if attempted to be put into effect in Europe or America to-day, would fail at its inception. Every such scheme must bear upon it the stamp of reasonableness proportioned to the reasoning capacities of the people. Thus far does intellect come in as an element of reform. Until credence can be secured, the necessary degree of sentiment can not be aroused. But the same was necessary for the systems enumerated. The condition of society is at all times so bad, the degree of suffering every-where witnessed is so great, and the amount of sympathy thereby excited and constantly experienced in society is so intense, that there has never been an age when there did not exist a deep-seated demand for some improvement of the existing state of things. The great moral systems of the remote past which have sought to accomplish this, owing no doubt to their failure to do so, were gradually transformed in more modern times into religious systems which made no promises for this life, which they perceived could not be fulfilled, but only held out the highest hopes for another life, by which the failure of fulfillment could never be proved. Both classes of systems succeeded because they were adapted each to the degree of credulity of the people to whom they were addressed. As the failure of the first began to be felt, the second were brought forward. Now that in our age the fulfillment of the promises held out by the latter is coming more and more in question, there has been a rapid and increasing amount of dissatisfaction, until the present prevailing systems now fail to respond to the still undiminished demand for better things. But the failure of all previous systems, both moral and religious, to fulfill their promises, makes some despair that any will ever be offered which shall succeed. Others think differently, and still hope that some fundamental movement may yet be set on foot which shall lead to the real improvement of society. The demand is for—1, an increase of enjoyment; and, 2, a diminution of suffering. It is, moreover, of a twofold character—subjective and objective. The motive principle of the former is egoism; that of the latter, altruism.

Egoism is the feeling which demands for self an increase of enjoyment and diminution of discomfort. Altruism is that which demands these results for others. Of course it can, and at the proper time will, be shown (vol. ii, pp. 146, 368) that, in the last analysis, egoism and altruism are one, that altruism is only an indirect or mediate form of egoism in which the motive is *sympathy*, i. e., a kind of feeling which results from the contemplation of suffering in others, and which is strong in proportion as the organization is delicate and refined. For this reason, and not because it is of a distinct nature, is altruism a far higher and nobler, though thus far a much less powerful, sentiment than egoism.

The great moral and religious systems referred to present us with a somewhat remarkable paradox. They have been grand successes in so far as exerting an extraordinary influence and absolute control over the wills and acts of men is concerned. They have been signal and complete failures in so far as the amelioration of the condition of society is concerned. While it is impossible to discern what would have existed in the world if they had not, it is possible, on the other hand, to trace to their direct influence an enormous amount of unquestionable evil, and that mixed with but a small quantity of demonstrable good.* The fact that every system imputes as much to every other is one very strong proof of this truth.

When I speak of the influence of these systems in controlling the destiny of mankind, I wish to disconnect this idea wholly from that of the true progress which I admit has taken place in society (vol. ii, pp. 168, 178, 385, 507). And when I assert that all the control that can ever be exerted over mankind must, in the future as in the past, emanate from the side of feeling and not of intellect, and promise a mitigation of the hardships of existence, at the same time I unqualifiedly maintain that all the true progress which has in fact taken place in the world has come from the side of intellect and not of feeling. And herein lies a second paradox. This finds its explanation in the fact that all the real progress that has been made in the world has been the result of accident, or, at least, of the operation of the uncontrolled and unknown laws of nature. There has been progress in civilization just as there has been progress in organic life, because the highest and best has been selected and preserved, and the lowest and poorest has perished. It is simply that man, as a progressive animal before the human period, and before the historic period, did not cease to be a progressive animal after reaching these periods. His progress has been the progress of nature, a secular and cosmical movement, not the progress of art, the result of foresight and intelligent direction. In short, man has not yet ceased to be an animal, and is still under the control of external nature and not under the control of his own mind. It is natural selection that has created intellect; it is natural selection that has developed it to its present condition, and it is intellect as a product of natural selection that has guided man up to his present position. The prin-

* President Andrew D. White, "The Warfare of Science."

ciple of artificial selection which he has been taught by nature, and has applied to other creatures, more as an art than as a science, to his immense advantage, he has not yet thought of applying to himself. Not until he does this can he claim any true distinction from the other animals.

Notwithstanding the failure of all systematic attempts thus far made to secure artificially the improvement of society, still, cheerless as the prospect may seem, the only hope of success in this direction is in other systematic attempts made in the same manner, and according to the same methods as those by which these have been established and carried on; that is, placed in the power of the feelings which alone are capable of propelling any social operations. If this is hopeless, then must the race be left to drift on under purely natural influences, and reach any stage to which the conditions found on the planet may be capable of carrying it. Let no one, however, be deluded by the thought that this cosmical progress, even in its own slow way, can continue for ever. It will hereafter be shown (vol. i, pp. 704, 706; ii, pp. 15, 210, 272) that this swarming planet will soon see the conditions of human advancement exhausted, and the night of reaction and degeneracy ushered in, never to be again succeeded by the daylight of progress, unless something swifter and more certain than natural selection can be brought to bear upon the development of the psychic faculty, by which alone man is distinguished from the rest of the fauna of the earth and enabled to people all parts of its surface. The resources of the globe are not inexhaustible unless zealously husbanded by the deliberative foresight of enlightened intellect.

But as the non-progressive systems of the past have, in fact, differed immensely in all their minor details, so there is no limit to the variation to which we may conceive some future and, possibly, progressive system subjected.

There can be no question of the mere power that resides in such movements. When we consider the enormous extent to which they have, as a matter of fact and of history, controlled the actions of men, we can only deplore the vast waste of energy which their failure to accomplish their end shows them to have made. Under the direction of religious organization empires have been established; wars of conquest and of propagandism have been waged; churches, mosques, cathedrals, and temples have been erected; and the whole surface of the globe has been transformed at the command of organized priesthoods.

To the candid and dispassionate judgment these historical facts combine with irresistible force to demonstrate the extraordinary power of vast moral and religious systems to influence the condition of society. But, if they can influence it thus to no purpose, or for evil, the question can not be suppressed, Why can they not as well influence it for good? Is there anything in the inherent nature of these systems which requires that they should necessarily be non-progressive or retrogressive? May they not as well be progressive? The fact alone that they do sometimes work for good would be sufficient to decide this question, if, indeed, it could be seriously raised. But, if it be possible to convert all this vast force into progressive channels, why is it thus allowed to run to waste, and why is it turned loose like a wild beast to rend society and neutralize the progressive tendencies of unimpeded nature? The answer to this question is to be found in the causes which have produced these institutions in the past. They have been the product, as before remarked, of the ever-pressing demand of suffering humanity for a better state of things; they have promised to supply this demand, and mankind have lent their undivided energies to their establishment and dissemination, in the firm conviction that they were competent to fulfill their promises. This unqualified belief, this unswerving faith on the part of the mass of mankind, is the true secret of their power. The only essential element of such a system, therefore, is a firm and unshakable conviction in the minds of the great mass of society that its success will have the effect of increasing human happiness and diminishing evil.

Now, at first glance it would seem that it would be as easy to secure this popular faith in a progressive as in a non-progressive or retrogressive system. It is, however, the misfortune of man's mental constitution, and of the constitution of nature in which he is placed, that the reverse of this is true. He is ever prone to seize upon the apparent and overlook the real, to pin his faith to the superficial and reject the fundamental, to follow after the fanciful and the imaginary and pass by the actual and the tangible. Such is the feebleness of the average intellect, and such the complexity of the truths of nature, that it would have been impossible in any past age, if it be not so still, sufficiently to commend the latter to the former to secure any firm and abiding conviction that the reform demanded must come through knowledge. The best example of this that could be adduced is the very truth which it would otherwise be necessary to state in this place, which is this: *The only means by which the condition of mankind ever has been or ever can be improved, is the utilization of the materials and the forces that exist in nature.*

Imagine, now, the difficulty which would attend the thorough and radical inoculation of this truth into the universal popular creed in such a manner as to induce anything analogous to the great emotional interest which past systems have exhibited among men! Yet the dogmas which have underlain these systems have promised nothing which this principle would not, if rigidly carried out, secure.

The difficulty is still further complicated by the necessity of adopting an entirely different method in carrying out this principle from that which has been employed in advancing the doctrines of past moral and religious systems. No amount of exhorting, of proselyting, of missionary work, of war, or of persecution, would in the least avail for this purpose. Most of these methods would tend to retard, and some to crush out, the movement in its infancy. An entirely new element would have to be added to the emotional force in order to secure success. This element is the guidance of the intellect. Not that the intellect is at all a propelling force. It is, and can only be, a directive force (vol. i, pp. 400, 476, 486, 599 ; ii, 100). But it is this directive force that would be absolutely required to secure the successful spread of this new gospel of progress. The intellectual directive force must further be exactly proportional to the emotional impulsive force; at least, it must never fall below it. In the other movements referred to, there has been no proportion between these two forces. True, the priesthood has generally exercised an intellectual control over the masses, but their directive efforts have too often been toward securing personal power, honors, and emoluments out of the seething passions of their credulous adherents. Instead of restraining these passions, it has generally been their policy to increase them to the utmost, recognizing that the intensity of popular feeling is the measure of their own power.

The character of these priesthoods suggests another serious difficulty, viz., that of preventing a scientific or industrial priesthood from re-enacting these evils. The only solution of this problem is to suppose it possible to diffuse the intellectual or directive force uniformly along with the emotional or propelling force. But this difficulty may be deemed wholly insuperable. If so, then the proposed system must be given up. For it would be impossible to carry it on, and insure the object which it has in view, in a state of society where the directive force was confined to an oligarchy who simply managed the operations of an impelling force residing in the passions of the masses. Not that wisdom, if properly applied to emotion, no matter where either should reside, might not secure the benefits sought; but because, from the constitution of man, it can never be properly applied where the two are vested in different individuals.

The fundamental law of human nature, and therefore of political economy, is that all men will, under all circumstances, seek their greatest gain. All the alleged exceptions to this rule are apparent only, and experience has a thousand times over established their entire unreliability as grounds of public policy. But, where the intellectual and the moral forces of a great social movement are separated, the temptations to self-aggrandizement on the part of those wielding the former are wholly irresistible. They never have been resisted, and it would be folly to expect that they ever would be. In such a movement, therefore, every individual must be both a force and a rein for himself. But it must be apparent to all that intellectual activity, coupled with enthusiasm, could never alone accomplish the great object of utilizing the materials and the forces of nature. Of course, originally, this is all that could have initiated this movement. But every one can not originate such work for himself. The originators must always remain a mere handful as compared with those who follow and elaborate. Whatever has been thus far done in this direction has been the work of nature. Necessity has led man to adopt a thousand ingenious means of supplying his needs. The inventions and discoveries that have thus far been made are, in one sense, the products of natural selection as much as are the improved nests of certain birds, or the dams of beavers. True, they have all been due to the guiding force of the intellect applied in aid of the propelling forces of hunger and want. And if the world is left wholly to nature, these agencies will continue for a great while to produce progress. The case is comparable to that which exists in plants and animals. Many of them are still in a progressive state. As the vegetable kingdom has for millions of years been slowly rising from sea-weed to moss, from moss to fern, from fern to cycad, from that to pine, and so on to the oak and the apple, and as the animal kingdom has, in like manner, continued to exhibit forms of a higher and higher organization from the monad to the man, so it may be expected that both these kingdoms will, for perhaps an indefinite period of time, continue this progressive differentiation. Yet how long, under nature alone, would it require to develop the wheat, the maize, and the apple, that human agency has brought forth? how long to produce the Ayreshire, the Devon, the Cheviot breeds of animals? And while the cases are not strictly parallel, since nature would never select just the qualities that man selects, still it gives us a faint idea of the enormous acceleration which we may imagine human progress to acquire if it could be made the subject of artificial instead of natural selection. I do not speak here either of generative selection, as it is practiced on animals and plants, with a view to improve the physical quality of humanity, although I recognize this as one of the great considerations that can not much longer escape the serious attention of those who lead the thought of the world. I desire to confine the comparison now wholly to society as an organism. The problem is to apply the vast emotional forces which are ever striving to improve society, but failing for want of the proper intellectual guidance, to some truly progressive system of machinery that shall succeed in accomplishing the desired end. As above remarked, the intellect alone can not do this. It must be joined to facts. In short, what is really required is *knowledge*. Knowledge is simply truth apprehended by the intellect. Intelligent mind, fortified with knowledge, is the only reliable form of the directive force. The only proper knowledge for this purpose is that which can be acquired of the materials and the forces of nature. As it is the utilizing of these which alone can secure the end sought, so the knowledge of these is the prime necessity in the exercise of a directive control over human zeal for the improvement of mankind. Hence the diffusion of this kind of knowledge among the masses of mankind is the only hope we have of securing any greater social progress than that which nature itself vouchsafes through its own process of selection. But the knowledge referred to is just that which is embraced in the word *science*, and the diffusion of it is the process which goes by the name of *education*. Therefore, the first element of a truly progressive system is *popular scientific education*.

It is thus clear how wholly different must be both the nature and the plan of operation of a truly progressive system from those of any of the non-progressive systems which have divided up the energies of the world in the past.

It may be asked: "Where can this knowledge be obtained? Must we go to nature for it and dig it out of the bowels of the earth before we can scatter it among men?" This is now happily unnecessary. Unaided nature, operating upon man as upon animals and plants, has impelled him to seek this knowledge for himself, and, obeying this strictly biological law, he has brought to light a vast mass of truth, sufficient, if properly distributed, to place society on the highway to permanent prosperity. But, as the movement, being a purely natural one, has been strictly egoistic, this mass of knowledge has remained locked up in the minds of a few persons, and has only been allowed to exert an indirect influence on the state of society, and scarcely any on the great majority of its individual members. Further, society at large, which has come into the possession of the greater part of this knowledge, has taken no pains to secure its diffusion among its members. The only means of obtaining this knowledge is for each individual to seek it out for himself—an effort which not one in a thousand could afford to make, even should he chance to have a desire. The great majority never even learn the fact that any such fund of knowledge exists in the world. Comparatively few have any idea of its value.

It is customary in our day to recommend in the strongest terms the extension to all our higher institutions of the facilities for increasing knowledge, for independent original research (vol. ii, p. 565). This is well, but the fact is that not one-hundredth part of the facts which original research has already brought forth are to-day obtainable by the one-hundredth part of the members of society, so that not one truth in ten thousand is fully utilized. Why go on bringing forth new truth, when in the existing state of society it is impossible to make a proper use of what we already have? It would not be difficult to demonstrate that this constant accumulation of materials for progress so far beyond the capacity of society to utilize them, or even to become conscious of their existence, exerts along with some direct benefits a large amount of indirect evil to society itself.* It is like gorging the stomach to repletion in the hope that thereby nutrition may be increased. And, just as this may with some safety be done by lowly organized creatures, while its practice by highly organized ones is certain to end in reaction and disease, so the early and lowly organized societies of the world may without danger have accumulated great masses of facts for the later and more delicately constituted ones to apply, while the same policy pursued by the latter makes a dangerous chasm between the intelligent few and the ignorant many which can not fail to accomplish the aggrandizement of the former at the expense of the latter. To this influence, if I mistake not, is to be ascribed the greater part of the evils of which modern society complains. Every cultivated man has often wondered at the extraordinary degree of refinement to which many branches of knowledge have been carried. Considered independently of each other, nearly every so-called science, not to speak of the arts both useful and æsthetic, has been pursued to the most astonishing heights of specialization, and carried out through the most delicate and multiplied ramifications. I need but refer to the great and useful sciences of mathematics, of astronomy,

* Professor E. L. Youmans's address before the Liberal Club of New York, June 5, 1874, in "Popular Science Monthly," vol. vi, p. 44; Professor F. W. Clarke, *loc. cit.*, p. 276. Dr. Jeffries Wyman has truly said: "The isolated study of anything in natural history is a fruitful source of error. No single experiment in physiology is worth anything."

of physics, and of chemistry. Still better illustrations, however, are found in the less practical sciences of zoölogy and botany. The incentive in these latter seems to have chiefly been mere fondness for the acquisition of facts. There is scarcely an animal or a plant in Europe, in America, or even in Australia, that has not been collected, studied, described, named, and classified. Volumes have been written and profusely illustrated with elegant plates to describe the species of certain plants and animals whose practical use to mankind is not appreciable, and is not in the slightest degree increased by such accurate knowledge on the part of a few specialists. Considering the number of important and fundamental problems which every science always presents, and the manner in which these are neglected, while such abstruse and useless niceties are spun out by specialists, I have been led to believe that, except as goaded on by personal want, the human intellect prefers trifles and hair-breadth subtilties to the serious investigation of truth. This tendency, so manifest in science, has, as all know, been still more pronounced in philosophy, and every human effort is constantly in danger of degenerating into a gymnastic.*

But not only is all the knowledge in the world confined to a few, but each different kind of knowledge is in the exclusive possession of a small class of these few; not only is the mass of mankind excluded from knowledge, but those who have any possess only a minute fraction of the useful knowledge extant. It is all chance-work; there is no system, no general scheme for the dissemination of truth. This is of course the worst feature, but second only to it stands the unorganized state of knowledge itself. If knowledge could be diffused, there is probably causality enough in the world to co-ordinate and arrange it. But, unfortunately, those who possess it have obtained it through the mere love of facts, and belong to the class who see only relations of co-existence

* Comte, "Phil. Pos.," vol. i, p. 26; Bacon, "Nov. Org.," lib. ii, Aph. 27, p. 417; Haeckel, "Schöpf.," S. 334, 639.

and not of dependence, and hence, as they hold on to their facts and are incompetent to classify them, they are never generalized and therefore never utilized; or else they come at their knowledge through the force of necessity, like the breeders and gardeners, and have no time or desire to inquire after principles. In either case, their knowledge remains useless, or exerts its beneficial effects only within a very limited circle. Unorganized knowledge can not be utilized.

The two prime elements, therefore, of any system that aspires really to benefit the race must be, first, the diffusion of existing knowledge universally throughout society; and, secondly, its organization, or *synthesis*, with a view to the establishment of the true relations of dependence which exist among all known truths. The first of these processes is *education*, the second is *philosophy*; but, as the former could not but result in the latter, this may for present purposes be neglected.

The whole philosophy of human progress, or *dynamic sociology*, may, therefore, be briefly epitomized in a few words: The desire to be happy is the fundamental stimulus which underlies all social movements, and has carried on all past moral and religious systems. These have been established in obedience to the deepest conviction and belief that they were able to accomplish the amelioration of the condition of mankind. They failed because misdirected, owing to the ignorance of man respecting nature, upon which alone all successful effort must be expended. The only real progress has resulted from such effort. Some progress has been made in spite of these badly directed and superficial systems, but it has been the result of the secular forces which have evolved man out of the animal state. The problem is, to guide these vast and acknowledged forces in a progressive instead of a non-progressive direction. To do this, something analogous to these past non-progressive systems must be established. There must be a set of principles, doctrines, or articles, to which, as a creed, the world shall give in its adhesion. These principles must be *true*, and be founded on the *natural*, and not *false*, as in previous systems, and founded on the *supernatural* (vol. ii, p. 266). The fundamental principle or first article of this new creed is, that *all progress is the result of the utilization of the materials and the forces which exist in nature.* The second is, that the true and only way of carrying out the first lies in the universal diffusion and thorough co-ordination of the knowledge now existing in the world respecting the materials and forces of nature—in short, the *scientific education* of all the members of society. But, as the second tenet is but the means of realizing, through the first and deeper truth, the immediate object of human desire, it would be sufficient if the latter alone could be made the direct and special object of popular *faith.* Before progress can be achieved, a public sentiment must exist in favor of scientific education as strong as it has ever existed in favor of religious education. If, by the term *education*, there can be constantly implied the two adjuncts, *scientific* and *popular;* if the word can be made to embrace the notion of imparting a knowledge of the *materials and forces of nature to all the members of society*, there can be no objection to the employment of this word *education* as the embodiment of all that is progressive.

Education thus defined is the available means of setting the progressive wheels of society in motion; it is, as it were, the lever to which the power must be applied. Give society education, strictly held within the assigned limits, and all things else will be added. Even the philosophy required to co-ordinate existing knowledge would be certain to come in time. Continuing, for the sake of comparison alone, the analogy of the supposed system with the systems of the past and present, we may imagine the creeds of the world supplanted by a similar faith in the progressive principle here formulated. The energies heretofore so powerfully directed to ecclesiastical work would then be directed to educational work. The school would fill the place now occupied by the church. The scientific lecture would supersede the sermon, and the study of natural objects and of standard scientific works would form a substitute for the study of sacred writings.

This, I must repeat, is a purely ideal scheme, and one which may never be actually realized, but it will help us to conceive of something more practical. For its realization would certainly accelerate the rate of social advancement in some such way as the artificial development of domesticated animals and cultivated vegetables, through human foresight and intelligence, has accelerated their natural development due to the blind struggle for existence. For it is just this blind struggle for existence that society, as a great organism, has been thus far making and is still making, while the proposed system is nothing more than the application to society of that foresight and intelligence which artificial selection applies to organic nature.

But, admitting, as we must, the impossibility of the adoption of any such system in any such abrupt manner as that pointed out, the question still remains, whether, with such a system as an ideal, there is not room to hope that something may be done which shall amount to an approximation to it, and this with a prospect of constant approach to its ultimate realization. This question I can now only answer dogmatically in the affirmative, leaving the reader, who shall desire to follow me through, to judge for himself whether satisfactory grounds exist for this conviction. But, even should his faith in the feasibility of the undertaking be weak, I shall expect him at least to agree with me that the organization of social progress and its artificial acceleration, if accomplished at all, must be accomplished substantially on the basis above set forth.

This broad distinction between natural development and artificial development, which receives so many striking illustrations from a comparison of the results of "natural selection" with those of artificial, or human selection in the animal and vegetable kingdoms, deserves an appropriate term for its distinct expression. Rather than search for a new term for this purpose, let us content ourselves with the adoption of one which has been for some time in use where it was once much needed, but where, although employed in the same sense, it has so distinct an application that at first sight the new application may not appear to be justified, although a closer view can not fail to show that it is the application only, and not the meaning, which has been changed. To this especial conception, therefore, of man, in his social capacity, seeking to improve society by the exercise of an intelligent foresight, in seizing upon the laws of nature and directing them to the ends which his reason, combined with his acquaintance with those laws, teaches him to be those certain to secure the advantage of society—to this notion let us apply the term *teleology*, which we may qualify, for the sake of distinction, as *anthropo-teleology*, and let us call this action on the part of man and of society teleological action, and the plans and measures thus adopted the teleological plans and measures of man and of society. Let us further designate whatever progress may be effected through this means teleological progress, and thereby distinguish it from the natural or genetic progress which has been thus far, and is still, going on.

From a purely etymological point of view, there is certainly as much propriety in this use of the word teleology as in that which applies it to the supposed purposes of deity. While its usefulness in this latter application, as a means of designating the fundamental idea that pervades a great school of philosophy, must be admitted, the real title to this use, regarded as an expression of any actual truth, is being latterly called rigorously in question. The most enlightened and advanced thinkers of this age reject this conception of a *theo-teleology* in nature, and science is steadily moving in the direction of explaining all phenomena on strictly genetic or mechanical principles. Should this school triumph, the term teleology, if restricted to that application, would be robbed of its meaning, and exist as a mere relic of an obsolete cosmology. But, just as its usefulness is vanishing in this field, another field is opened in which it is greatly needed, and can not fail to do good service. For, when we reflect upon the matter, we perceive that man is κατ' ἐξοχήν the proper teleological agent. Viewed in the widest sense, man is of course but a product of nature, and his acts are the effects of complicated antecedent causes. In this sense there is, and can be, no teleological action. But it is neither convenient nor customary to speak in common parlance from any such profoundly philosophical stand-point. For all practical purposes the acts of men are regarded as emanating from motives which lie within each individual. They are performed in obedience to plans, designs, and purposes, which exist in the minds of individuals. This is just as true as though these subjective motives were as wholly without antecedent cause as the majority of men believe, and as our "moral-science" teachers tell us that they are. But design or purpose is the essential basis of teleological action. Human acts are as truly *causæ finales* as if they emanated from a First Cause.

Not only is this true, but there can be no doubt that it was his own teleological action that caused man to ascribe such action to deity. Historically viewed, the theo-teleological conception grew out of the anthropo-teleological fact. Teleology, as popularly understood, is simply one of those anthropomorphic conceptions of which the history of human beliefs furnishes so many examples. In indicating a new and useful application, therefore, of this term, we do but restore it to the original object from which the conception first emanated, and assign to it a meaning which we know to represent a reality.

Now, the kind of social progress which is needed is teleological progress. The slow and imperceptible genetic progress which society has thus far made is barely sufficient to keep pace with the increase of population. Its entire increment toward improving the condition of society is neutralized by the rapid multiplication of individuals which it itself enables the race to carry on (vol. i, p. 703; ii, p. 209). There is very little perceptible amelioration of the condition of society at large. The world does, indeed, enjoy thousands of material blessings which this unorganized progress has scattered over it; but when we consider the proletariat, when we look into great cities or out on large plantations, or visit those immense centers of production, the factories, we realize that, while the intellectual and material condition of society has reached almost giddy heights, the moral or emotional condition of man has scarcely advanced at all. There still remain the overworked millions on the one hand, and the unemployed millions on the other. There are still all the depths of ignorance, poverty, drudgery, and nameless misery that have ever been the baneful concomitants of human civilization. I am aware that it will be said that all this is a necessary evil, that it arises out of the inherent depravity, the idleness, or the perversity of human nature in some of its phases, and that it is incurable. This, however, is precisely the issue. There are some who think it quite unnecessary and the result of the wholly unorganized state of society itself—that these wretched ones are simply the unfortunates who, in the great soulless struggle for existence and scramble for gain, are crowded to the wall. There are those who believe that the organization of society on such a basis as shall put these evils in the way of immediate mitigation and ultimate removal is not a chimera. In fact, almost every one, without admitting it, entertains notions more or less definite of this kind. Such conceptions were far more prevalent in past ages than they are in our own. The failure of all the attempts in this direction has led to much skepticism in these later times. All the moral and religious systems of which mention has been made have been nothing more or less than so many attempts to realize a teleological progress. Even if the hope of securing any improvement in this world were renounced, and all efforts concentrated on obtaining the same results in a future life, the labors of missionaries and propagandists would still be simply teleological attempts to secure artificially this great good for man.

But not moral and religious systems alone belong to this class; government, too, with all its usurpations and oppressions, has always avowed, and still avows, as one of its primary functions, the temporal advancement of citizens and subjects. It has thus expressly declared for the feasibility of this teleological improvement. That it has almost without exception failed to realize the results claimed has not prevented nearly all mankind, not in the past only but in the present, from giving in their adhesion to this doctrine, so that even those who repudiate it in the case of religious institutions generally accept it in the case of political ones.

We shall come back to the question of the legitimate functions of government as well as to that of the nature of religion as a social factor (vol. ii, pp. 212, 252). Let us content ourselves here with the most general survey of the doctrine which has in modern times been indicated by the term *laissez faire*. Indeed, let us expand this notion beyond the limits usually assigned to it, and embrace not only the question whether human government can rightfully or successfully undertake to initiate and conduct reformatory and progressive measures, but with this the wider one, whether society, no matter by what means, whether through political, moral, religious, or any other system of institutions, regulations, or measures, can, either rightfully or successfully, prosecute any plans having the improvement of its own condition for their object. The question of right can be disposed of with a word. We do not care to discuss the question as to whether society or any other organism has a right to manage itself. Throughout nature the rights of individuals to carry out their desires are limited only by their power to do so. Man only *pretends* to do differently. A bird's-eye view of human history shows him to have acted on the same principle as the rest of nature, the principle that "might *makes* right." *

Not until we have succeeded in banishing the metaphysical conception of abstract right, and taken down the unrealizable standards of an imaginary disinterestedness in action, shall we be prepared to discuss intelligently the conditions of man's progress conceived as capable of accomplishment by his own efforts. The first step in this movement is the recognition of the primary law that in the last analysis all results are accomplished by force. Although this proposition may shock the minds of many when brought forward as a law of society, it is really no more than saying in other words that all effects are produced by causes, which is a truism. But its effect as a law of sociology is to establish the necessity for a paramount source of power in human society.

It is here that the new science is destined to be strongly antagonized by the growth of erroneous ideas respecting liberty. The so-called "abstract rights" of mankind must be denied if society is ever to become the arbiter of its own destiny—in theory, that is, for it is impossible that the real enjoyment of liberty should be thereby in the least diminished, while the sum of human happiness must be greatly increased, and this is the only conceivable object of any right. All the prevailing theories of human rights are but ideal conceptions which not only have never yet been realized, but in the nature of things never can be. In point of fact, all things are now and always have been governed by force, and all the attempts to disguise it under the color of abstract right have only served to make it easier for the unscrupulous to accomplish their personal aggrandizement. Government has always wielded an iron scepter, which the forms of law have only rendered the more inexorable. The most complete recognition of the right of force in human

* "Ne pouvant pas faire que ce qui est juste fût fort, on a fait que ce qui est fort fût juste" (Pascal). See Cousin, "Du Vrai, du Beau et du Bien," p. 396.

society—the only rule known to the rest of the sentient world, and the only one ever acted upon by mankind—could by no possibility render matters worse than they are. But this recognition would put it in the power of the controlling authorities in society to introduce progressive elements into government, and make the coercion which is now so fruitless a positive and increasing future benefit. Under the negative system of government which has prevailed thus far, the world naturally looks round and asks what return it has received in exchange for all this sacrifice, and it is no wonder that many insist that the account is against government, and would gladly dissolve the partnership and annul the "social compact."

The remainder of the problem can only be profitably discussed in the abstract. For there is, on the one hand, nothing in the experience of the past to teach us the possibility of the ultimate success of teleological measures, while, on the other hand, the short-sighted and profoundly mistaken character of nearly all such measures as have thus far been tried renders them wholly useless as signals either to follow or to shun.

If we rise a step higher and expand our term teleology one circle wider, so as to make it embrace the acts of the individual members of society performed solely for their own benefit, and without conscious application to the good of society, we find that all the increment which mere "natural selection" has produced in the direction of human advancement has come from this source, which on analysis proves to be simply a higher form of natural or genetic development; for, given a being with the degree of organization possessed by man at the time he began this new sort of development, including the cerebral, such a result must take place as a purely natural process. Now, this real progress thus secured, and for which society as an organization deserves no credit, has been the result, as before remarked, of the discovery and application to human needs, each individual for himself, of certain valuable materials and laws which existed in nature. Nothing more than this can be said of the last and greatest of discoveries and inventions. A machine is nothing but a collection of material substances so formed and adjusted by human foresight (teleologically) as to perform valuable service for the inventor. Every invention is simply an anthropo-teleological direction of some of nature's forces into channels which carry benefit to man. These natural forces always exist. They operate according to fixed and invariable laws. They can neither be created nor destroyed, but they can be *controlled.* All the material civilization man has achieved has resulted from his successful teleological control of these forces of nature. This is not alone true of machinery, that is, of what are called mechanical or physical forces, although of these he controls some of the most subtile and inscrutable, such as light, heat, electricity, etc. As we have already seen, he also takes advantage of what are generally distinguished as vital laws, of the laws which regulate the phenomena that living beings manifest. It is probable that he began to control the complicated animal forces before he undertook to extend his dominion over the perhaps less complicated vegetal ones. The pastoral period is usually placed before the agricultural. The domestication of a wild animal, not less than the cultivation of an indigenous cereal or fruit-tree, is a simple application of the teleological agency. The high degree of refinement to which this control of the vital forces has been finally brought is strikingly attested by the skill attained by both breeders and horticulturists in artificially improving animals and plants. Man even controls emotional and intellectual forces. In the training of animals he does this to a limited extent. He does the same in governing those of his own race. He does nothing else when he governs himself. And this is all of self-control.

We see that by the aid of a more or less powerful intellect put in possession of a greater or less number of natural truths man has succeeded in so directing his own vital or muscular movements as to regulate, in a greater or less degree, the external physical or mechanical movements of the material objects around him, and by obstructing their advance here, intensifying their velocity there, and forcing them into harmless or useful channels in other places, he causes nature first to leave him unmolested, and then actually to serve him in the most advantageous ways. It is in this alone that civilization consists. It is by extending this dominion over other higher and yet unsubdued forces that all progress in the future must be secured.

At first this may seem a digression. But our problem was, whether it is possible for society to improve itself. Society is simply a compound organism whose acts exhibit the resultant of all the individual forces which its members exert. These acts, whether individual or collective, obey fixed laws. Objectively viewed, society is a natural object, presenting a variety of complicated movements produced by a particular class of natural forces. The question, therefore, simply is, Can man ever control these forces to his advantage as he controls other, and some very complicated, natural forces? Is it true that man shall ultimately obtain the dominion of the whole world except himself? I regard society and the social forces as constituting just as much a legitimate field for the exercise of human ingenuity as do the various material substances and physical forces. The former have been investigated and subjugated. The latter are still pursuing their wild, unbridled course. The former still exist, still exhibit their indestructible dynamic tendencies, still obey the Newtonian laws of motion, still operate along lines of least resistance. But man, by teleological foresight, has succeeded in *harmonizing these lines of least resistance with those of greatest advantage to himself.* He has made the winds, the waters, fire, steam, and electricity, do his bidding. All nature, both animate and inanimate, has been reduced to his service. One field alone remains unsubdued.

One class of natural forces still remains the play of chance, and from it, instead of aid, he is constantly receiving the most serious checks. This field is that of society itself, these unreclaimed forces are the social forces, of whose nature man seems to possess no knowledge, whose very existence he persistently ignores, and which he consequently is powerless to control.

But we have said that the very systems, moral, religious, political, of which mention has been made, are but so many direct attempts to control society and improve its condition. True; and they failed to accomplish their object because they did not recognize the very laws and forces which they sought to control. The extraordinary influence which they have, in fact, exerted shows how great would have been the result had they really been directed in channels of human advantage. They recall the misdirected efforts and hopeless dreams of the crazy inventors of "perpetual motion," and, as attempted inventions, they have failed for the same reason; these complicated machines have not worked, because they were contrived in ignorance of the forces they were expected to control.

Again, the defenders of *laissez faire* will object that society has always done better when let alone; that all efforts to improve the moral or material condition of society by legislation and kindred means have not only been inoperative, but have in the majority of cases done positive harm, often to the very cause they were intended to subserve.

If it could be proved that they had always been absolutely inoperative, the case would, perhaps, be somewhat discouraging; but, if they can be shown to have had an evil effect, this is all we can hope or desire. For, if they can do *harm*, they can do *something*, and nothing is left but to make them do *good*. Legislation (I use the term in its most general sense) is nothing else but invention. It is an effort so to control the forces of a state as to secure the greatest benefits to its people. But these forces are social forces, and the people are the members of society. As matters now are and have thus far been, government, in so far as the improvement of society is concerned, has been to a great extent a failure. It has done good service in protecting the operation of the natural dynamic forces, and for this it should receive due credit. But it has also to be charged with a long account of opposition to science and oppression of aspiring humanity. But why has it failed as a promoter of the social welfare to which it has laid such special claims? Because legislators, as inventors, have proved mere bunglers; because they have known nothing of the laws of society; because they have been ignorant of the forces over which they have sought to exercise control. Success in invention must be limited by the acquaintance of the inventor with the forces that are to propel his machine. Man rarely stumbles by mere chance upon any great invention. Art is measured by science, and a comparison of its progress since the scientific epoch began with that of the ages that preceded that epoch proves incontrovertibly that all progress in practical art must be preceded by progress in science (vol. ii, p. 193). Before science taught man the nature of physical laws, all attempts at invention, except of the simplest kind, were just such wretched miscarriages as attempts at progressive legislation are to-day, and for the same reason, viz., that the inventors possessed no science of the field of natural forces over which they sought to exert an influence. Before progressive legislation can become a success, every legislature must become, as it were, a polytechnic school (vol. ii, p. 252), a laboratory of philosophical research into the laws of society and of human nature (vol. ii, p. 249). No legislator is qualified to propose or vote on measures designed to affect the destinies of millions of social units until he masters all that is known of the science of society. Every true legislator must be a sociologist, and have his knowledge of that most intricate of all sciences founded upon organic and inorganic science. For the organic world is a product of the inorganic, and in its most general aspects is governed by the same laws, and man is at best but a highly organized animal, and is as fully under the dominion of biological laws as is the humblest worm. Society is ruled by the simple resultant of all the physical and physiological forces which control its members. How profound, then, and comprehensive, must be the science of sociology! How utterly incompetent, from this ideal stand-point, are the men who have always held and still hold the reins of power in society! And what wonder that all their short-sighted efforts to promote its material welfare have proved abortive, and that their schemes so often react upon themselves and "return to plague the inventor"! Attempts of legislators to control society have proved inoperative for what they were designed to accomplish, because the true springs were not touched or known. They have more frequently done harm than good, because, while there may be many wrong ways, there can be but one right way in which to harmonize the social impulses with the social interests.

This comparison of legislation to invention is not a mere accidental or convenient analogy. So soon as the mind rises to grasp the conception of social forces possessing all the essential attributes of the physical forces, and differing from them only as these differ from one another, the actual identity of legislation, as it should be conducted, with mechanical invention, as it is alone successfully conducted, becomes at once obvious. The successful inventor, knowing as he first must the nature of the forces and the objects with which he has to deal, so adjusts the latter that the former, though in no way increased or diminished or changed in their essential nature, will, by their natural operation, produce results beneficial to human interest. The true legislator must do precisely this and nothing else. The only difference is, that he is dealing with social forces and objects instead of physical ones.

Considering the physical forces from the stand-point of their manifestations, we may conveniently divide them into two classes: 1, impelling forces; and, 2, attracting forces. The consideration of the essential nature of force in the abstract may be left for a future place (*infra*, pp. 228, 291); the classification here given does not pretend to be fundamental, but only auxiliary to the present discussion.

Perhaps the greater part of the mechanical devices which are made have to deal with attractive forces; at least, a large amount of the mechanical invention accomplished rests on the general principle of removing obstacles to the flow of these forces in certain desired channels. True, there are cases in which heavy bodies, such as water, must be forced upward against the direction of gravitation, and where light bodies, as gases and smoke, by special contrivances are made to descend against the force represented by their buoyancy, but wherever this is necessary the inventor always knows that it must be done at a large expense of energy drawn from some other source. Now, to this there seems to be a complete analogy in human attempts to direct the social forces. In this field, as in the other, the coercive method is necessarily attended with great loss, and wherever it can be avoided it certainly should be. Contemplated from this stand-point we may regard all legislation as belonging to one or the other of the two general classes: 1, compulsory legislation; and, 2, attractive legislation. The analogy with physical experimentation thus becomes complete. In whichsoever department we look, the same truth is manifest that, wherever this is possible, the attractive method is superior to the compulsory one, a superiority which is due to the actual loss which must necessarily be sustained by the latter method.

The history of mechanical invention, from the earliest and lowest forms of it to the latest and highest, shows a gradual advance in the substitution of the attractive for the coercive method.

The primary attempts of rude peoples to intensify the forces of nature consisted in the slightest possible advance upon the purely coercive method which is called "brute force." In brute force pure and simple, there is no device, no attempt to employ physical forces or laws. The entire action is performed at the expense of the muscular powers of the agent. But the use of a club constitutes such an advance, and the momentum which it acquires in swinging through the air serves in a strictly artificial way to intensify the muscular power. From this to the bow and arrow, and from that to the gain-twist rifle or the shell-mortar, there is a gradual advance in this one direction of substituting the attractive for the coercive method; of adjusting the forces so as to render them self-acting, instead of having to assist them by personal strength or other forces.

We should find the same to be equally true of any other branch of human invention. The implements and machinery required in every industry have grown up under similar conditions, and their completeness and success depend upon the progressive recognition and application of the same principle, while failures in efforts to perfect them (and there have been many) have resulted in thousands of instances from attempts to coerce the physical forces into channels which were contrary to their special nature and tendencies. Wherever this has actually been done (and there are cases in which it is necessary), it has been at an actual loss of force supplied from some other source.

In the department of social forces most of the attempts to control them have thus far been made according to the coercive method; and this illustrates, in a remarkable manner, the infantile state of the science of sociology. We are living in the "stone age" of the art of government. We shall not emerge from it until the principle of "attractive legislation" is thoroughly understood and applied. This is by no means a new method, because it is the same that is principally employed in all other forms of invention—that is, in all other attempts to direct natural forces into channels advantageous to man. The existing laws on nearly all subjects are prohibitory, compulsory, penal. They appeal to the fear of punishment as the sole deterrent. Very rarely do they promise reward. They are based on the assumption that men are constantly prompted by their desires to perform acts injurious to the interests of society at large. They forbid such acts, and affix the penalties. The citizen is still at liberty to perform the act and pay the penalty; but it is usually more to his interest to refrain from the act and escape the penalty. But, whichever course he prefers, he necessarily loses something. A portion of his liberty (vol. ii, p. 232) is abridged. Some of his desires must fail of gratification. This is a loss, however viewed. It is commonly regarded as the necessary sacrifice which each member of society is assumed willingly to make for the general good. But, when the principle of attractive legislation is fully understood and put in operation by competent legislators, it will be seen that this supposed "necessary evil" will be in a great measure removed. Instead of continually damming the stream of human desire, as has been so often done in the past, until it finally bursts over all its barriers and whelms everything in the ruin of political revolution, men will learn to direct it into channels not only innocent but useful. It will be found that the degree of liberty necessary to be surrendered for the good of society is far less than has been supposed. The very complexity of social phenomena will serve only to multiply the resources of the thoroughly competent explorer in this field of natural law. Diligent search will be made for principles which will render human legislation self-executing. Springs of human action will be sought out which, when the proper artificial adjustments are made, will spontaneously work out results beneficial to all. Many of the propensities now regarded as wholly bad will be found to be capable, by the proper adaptations in the circumstances, of producing great good. Such discoveries have been common in the history of all the physical sciences.

A so-called human "law" is simply an adjustment of the circumstances which human action influences, and which influence human action. It is at best only a *regulation*; it is merely an attempt to control and modify the results of the real *laws* which exist in society. These laws are the expressions of actual forces as real and natural as the mechanical forces of matter. These forces, which can neither be increased nor diminished, may, like all other natural forces, be antagonized and brought into the state of equilibrium. The forces remaining undiminished, their manifestation may be wholly or partially suspended by the presence of counter-forces. The normal condition is the dynamic one. The forces, so long as unimpeded, produce motion. Motion produced by the social forces is action. So long as it is free, society will act. This is the sole condition of all social progress. Interpose obstacles to the movement of these forces, and it is slackened or arrested entirely. A statical condition is brought about. Action is sluggish and labored or ceases altogether. Social stagnation results. Such is the condition of those societies which are under an absolute despotism. Progress is impossible. In every case the degree of activity, and therefore of progress, is proportioned to the degree of liberty, *i. e.*, to the degree to which the natural play of the social forces is unimpeded and unrestricted. The normal tendency of all compulsory legislation is to restrict human liberty. It interposes a counter-force to the natural social force, and, in so far as it produces any effect, diminishes the outward manifestation of that force without diminishing the force itself. It brings about a partial or total condition of equilibrium, and converts the normal dynamical into an abnormal statical condition. This is so much clear loss to social activity and social progress. If it be said that the activities thus arrested were injurious ones, and were better suppressed than exercised, the reply is, that so much force has been lost by equilibration, and this should have been saved and conducted into useful channels. And if it be further insisted that it could not have been so conducted, the answer is, that this is precisely the issue. The sociologist who really believes there is such a science has a right to claim that all the social forces may be utilized as the physical ones have been. He classes those who maintain the contrary along with those who once believed that the thunders were only engines of destruction, the winds powers of evil, and the gases demoniacal spirits. Evil is only relative. Whatever produces injury is evil. But in the physical world we find nearly all the forces producing both good and evil, according to the degree to which man has placed them under control and subjected them to his service. The vast benefits and injuries wrought by fire form a striking illustration of this. But the elements —the waters, steam, electricity, and even light—are also examples. If any one imagines that any social forces exist which are wholly bad, it is because he has not considered these facts in the light of the history of science.

The social forces only need to be investigated as the rest have been, in order to discover ways in which their utility can be demonstrated. Here is a vast field of true scientific exploitation as yet untracked, and which to the legislators of this age is not known to exist. To just what extent the present evil tendencies of society may be turned to good, under the management of truly enlightened legislation, it is impossible to predict. If the domain of social phenomena is as completely one of law as that of physical phenomena—and between this and total absence of law there can be no intermediate condition—then may we logically expect the same measure of success, in proportion as these laws are known, which marks the progress of human supremacy in the material world.

Such a degree of social progress simply bewilders the mind, but not more so than our material civilization bewilders the mind of the savage; and in the art of politics we are still savages.

Illustrations of the nature and operation of attractive legislation are as yet difficult to produce, because so few attempts of the kind have ever been made. Many approaches toward such a mode of legislation might, it is true, be referred to.* A single example, itself somewhat imperfect, will be here submitted.

Prohibitory temperance legislation, with its unsatisfactory results, is familiar to all. A substitute for it has been adopted in certain localities, by which the person suffering damage to property or injury to person committed by an inebriate, has his or her remedy against the vender of the intoxicating agent. This law is said to work admirably, by placing the venders of liquors on their guard against selling any one customer too much. It executes itself, because where injury is done it is the party injured, and not the police, who demands indemnity. It calls in the force of avarice to neutralize that of appetite, and thus the good of society is subserved at all points. This example belongs to the negative class of those measures which may be embraced under the term attractive legislation. Two forces, both useful when moderate but injurious when in excess, so far spontaneously antagonize each other as to reduce both to the point of safety and advantage.

But social science, when it shall have once fairly passed to its stage of application, will not stop here. It will proceed to devise measures and perfect adjustments, which will not only convert the strongest and thus far most dangerous tendencies of society into beneficial ones of the same strength, but it will also intensify existing good impulses, and create new ones by judiciously holding out great and certain rewards. There are many ways in which the progressive forces of society may be augmented and their beneficial effects multiplied. This does not involve the impossible task of increasing their general sum. The effects are increased on precisely the same principle as the effects of a battery are increased by a wire coil, or those of the solar heat by a lens. This can

* For further examples, see vol. i, pp. 518, 580; ii, 249, 392.

be done by the proper adjustments of the objects experimented upon, by the adoption of ingenious devices whose success can be predicted from a thorough knowledge of the forces to be dealt with. This is the essence of all invention, and will be as applicable to society as it has been to electricity or to light.

In order more fully to comprehend the futility of attempting the progressive control of society without the most fundamental knowledge of the principles by which it is governed, we should consider the fact that nearly all the phenomena of nature have at first appeared not merely inscrutable but paradoxical. To the primeval mind the "book of nature" is but a collection of Sibylline leaves which have been first stirred by the wind.

Science may be defined as an *explanation* of the phenomena of the universe as presented to the senses. This implies that these phenomena need explanation, which is true. It is often said that the first presentation of a natural phenomenon is as likely to elicit a false as a true interpretation from the untaught intellect. This is much less than the truth. So far from the chances being equal, they are almost infinity to one against the true interpretation of any natural phenomenon on first observation by the untutored mind of man. I do not say there may not be cases in which the first impression from the senses may be in correspondence with reality. It is, of course, true that new facts appealing for the first time to the cultivated and experienced minds of civilized men often receive an immediate interpretation in harmony with reality, but for this they have the advantage of a wide experience with related phenomena and acquired knowledge of the true meaning of other facts upon which these depend. And even here error is constantly occurring wherever the new phenomena are somewhat remotely or obscurely related to the acquired knowledge. It may be laid down as a rule that the normal deductions of the intellect from the crude impressions of sense, received from objects not obviously related to others already acquired by experience or education, will be uniformly incorrect. Not only so, but in a great number of cases they will be the exact reverse of the reality. In other words, the apparent, where no acquired data exist for directing the judgment, will generally differ widely from, and often be the opposite of, the real. This seems to result from the nature of things, from the necessary fact of finite intellect and the actual laws of physics and mechanics.*

We are speaking now only of phenomena, but, to show how universal is the law, we might demonstrate that it extends even into the domain of metaphysics. What is the relation of phenomena to *noumena?* Not a philosopher of any note can be named who has ever held that the former bear any direct resemblance to the latter. Most metaphysicians insist that they are different in all respects, many that

* The rationality of action depends not upon the power of a being to reason, but upon the correspondence of mental deductions with objective reality. The effect of an intoxicating stimulus or of delirium or insanity on the individual's action is analogous to that which would result if a perfectly rational person were conceived to be placed under surroundings so wholly unlike those to which he had been accustomed that no single object should possess a resemblance to any that he had ever perceived with his senses. Under such conditions his reason, however vigorous, would be wholly useless; all his conclusions would be utterly false, and his actions correspondingly wild and maniacal. He could not be distinguished by those to whom the surroundings were familiar from a real lunatic, and to all intents and purposes he would be one, with the sole difference that his condition would be the result of objective or external instead of subjective or internal derangement. For what we call "returning to ourselves" is simply a return to surroundings so familiar that we are able to draw correct conclusions from them. A diseased state of the brain brings strange objects before consciousness, which are wholly out of harmony with objective reality, and the deductions made from them, and accompanying actions performed, are necessarily wild and incoherent. It must, moreover, be true that this aberrant state of mind and action admits of all degrees, and irrespective of whether due to subjective or objective causes. Therefore, just as we find all shades of insanity due to cerebral derangement, so we have all degrees of irrationality due to ignorance of the environment. It may have been some such train of reflection as this that moved Socrates to ask the question which I have adopted as the motto of this work (see title-page).

there can be no possible relation of any kind between them, while Herbert Spencer's ingenious theory of "transfigured realism" * makes the one but a view in perspective of the other.

But, excluding all metaphysical comparisons, the phenomenon of sense-impression itself is a paradox. Physiologists now tell us that, instead of feeling with our extremities, as we seem to do, we feel with the brain, or at least with certain interior nerve-centers. But, passing to the objective, all the deliverances of the most important of our senses, that of sight, would be inverted but for the aid of experience which corrects the error too early in the life of each of us to be remembered. These and other similiar instances, however, are such as the necessary experience of the organism will correct without the aid of instruction from without or effort from within. They are valuable only as showing the great generality of the law of paradoxes.

As we emerge into the domain of general experience we find the law the same, but the consequences become more and more serious the more remote and obscure the relations of known to unknown phenomena, for in the same proportion does the mind require more and more experience and instruction for their true interpretation.

There is, first, the great astronomical paradox of the earth's diurnal revolution. The sun, moon, and stars appear to revolve around the earth, and no one would ever think of accounting for the phenomena on any other principle were he not taught the true explanation. All antiquity believed, and the majority of mankind still believe, the exact opposite of the truth in this respect. It is only within the last three hundred years that the geocentric theory has been fairly superseded by the heliocentric, even among the *élite* of humanity.

Then there is the paradox of the earth's support. To the primitive mind the conception of a world, of whatever

* "Principles of Psychology," vol. ii, p. 496.

shape, suspended in space by means of equilibrating forces, was impossible, and all mankind believed that it rested on some other object or support, the intellect not yet being strong enough to extend the series and realize the difficulty of the explanation.

Next comes the paradox of the earth's shape. To the eye of sense it seems flat. It has been demonstrated to be spherical, or nearly so. What an immense delusion! And yet in the nature of things it was necessary. And how much longer has error prevailed than truth!

Again, take the age of the earth. Although not so obtrusive a paradox, this has perhaps led man further into error and delusion than some of those already mentioned. All the old cosmologies prove that the evidences furnished to primitive man by the face of nature led him to assume for the age of the earth a period far too short—nay, thousands, perhaps millions of times too short. The truth of its hoary antiquity now just begins to dawn upon us after the most thorough investigation of the materials of which its crust is composed.

The great antiquity of the human race is another paradox, and one allied to the last. It resisted all efforts at explanation for a century longer, and the truth has reached a much less number of persons than that of the antiquity of the globe. Yet, who shall measure the evil that this long-obscured truth has worked in society? Who shall predict the good its revelation is to accomplish?

To primitive man the wind is a paradox. An invisible power, it could only be likened to mind or spirit, and was usually endowed with intelligence and will.

As observation began to be made of the substances found on the globe, many other equally mysterious and invisible gases were set free, and these were all regarded as demons.

Gravitation was another profound paradox, and one which has scarcely yet been redeemed from this category. Things seemed to gravitate toward the earth because it was their nature, a mere "vicious circle." Scarcely a better argument can be adduced to-day, but immense progress has been made in bringing the whole solar system at least under this one law.

The real variability of the condition of the earth's crust is a stubborn paradox which has required a Hutton and a Lyell to explain. Under the deluding error of its present stability, the great Cuvier invented his cataclysms, which only lost their last defender with the death of Louis Agassiz.

The indefinite variability of the forms of life on the earth is a still more subtile paradox, and some who are thoroughly acquainted with these forms still cling to the testimony of appearances.

The natural evolution of the solar system, first systematically formulated by Immanuel Kant, is now pretty generally accepted among advanced thinkers as a substitute for the explanation of special creation which in the nature of the human mind was the first and apparent one. With greater or less modifications, this truth will doubtless one day be recognized as one of nature's many paradoxes.

The genetic or *monistic* origin and development of life on the globe is fast passing through the same phases, and is now on its high way to recognition and admission to the class of truths whose opposite is first long believed because wearing the outward garb of reality.

But this truth must soon carry with it the deeper and still more paradoxical one that organic and inorganic nature are one. Evolution itself is a paradox, no matter into what department of it we may inquire.

Man's animal nature is a paradox. Evident as it really is that a man, viewed from a physical stand-point, is an animal, still a variety of causes, some of them purely conventional but none the less natural, have conspired to prevent the recognition of so obvious a truth.

As we ascend the scale, we find that mind itself is not a mystery only, but a true paradox. Beginning with the senses, every perception is paradoxical. We think we feel and see definite objects. No doubt we do, but they are not what they seem to be. All that affects us is the medium. We hear only vibrations of air; sight is but the contact of a paradoxical ether. Color is an illusion, residing in the eye, or rather in the ether that penetrates it, and not in the object. Consciousness itself is in a certain sense a paradox. It appears to be wholly under our control and independent of external influences. Yet there are many substances which, taken into the system in various ways, instantly rob us of all control of the mind. It relaxes into coma, or flies into delirium, according to the objective nature of such substances.

Finally, the will, that highest power of mind of which we boast so much, is, if not a chimera, at least a far different thing from what it appears to be. The real paradox here is the truth that it is an effect as well as a cause. Like the universe, like life, like man himself, like the other faculties of mind, the will is a genetic product of cosmical law. The illusion consists in supposing that our will is subject to our orders, that it is in any sense free. Yet here in the dependence of the will we have a paradox which clings with the utmost tenacity, even to the most enlightened of mankind. They have been compelled to admit the monistic principle in the celestial bodies, in the inorganic world, perhaps in the organic world. They may be even willing to agree that man is himself a genetic product, that brain has been mechanically evolved, that sensation and even thought are the effects of antecedent causes, but, when the great demi-god *will* is sought to be rolled in, they take fright and resist this last encroachment. These several classes of mind only show the degrees of causal power with which they are endowed. A full complement of causality never allows itself to be arrested by the consideration of consequences. If the universe is the theatre of law, freedom is a delusion.

Last of all must we add the paradox that society itself is the domain of law, and that its movements, so far from being sporadic, irregular, and incapable of classification or prediction, are the strict determinable products of antecedent causes, which can be studied and known by man in the same way that the causes of physical phenomena have been studied and learned by him—by the scientific method. Although, when we consider particular acts of individuals or of communities, they seem to have emanated from their own arbitrary free-will, and therefore, so far as science is concerned, to be purely fortuitous and incalculable, yet, when vast numbers of such acts are collected, co-ordinated, and tabulated, they are found to fall readily under a few general laws more or less modified by numerous special laws; proving that even this great field of nature belongs to Science the moment she sees fit to reclaim it.

We perceive, then, that not only is nature wholly unknown to primitive man, not only is it full of mysteries and deep-hidden secrets, but it is full of actual illusions, deceptions, and paradoxes. It matters not in what field of that knowledge which long study of it has brought forth we may look, we find that the true condition of things was not merely unknown, but that the actual manifestations of natural phenomena have, from their very nature and that of the human mind, led man to believe things were other than they are, often precisely the reverse. It may almost be stated as a rule that appearances are the opposite of realities. Not ignorance alone, but *error*, is the necessary result of strict obedience to the dictates of sense, before it is accompanied by the most thorough and prolonged process of scientific verification (vol. ii, p. 417). Things are *not* what they appear to be. They are usually wholly different, very frequently just what they seem not to be. Nature is one great paradox, embracing many minor ones.

Briefly to recapitulate: there is the astronomical paradox of the earth's true motions; the terrestrial paradoxes of the earth's figure, support, and antiquity; the geological paradox of the changes going on in the earth's crust; the meteorological paradox of the winds; the chemical paradox of invisible gases; the physical paradox of gravitation; the cosmological paradox of the evolution of the solar system; the biological paradox of the variability of species and the evolution of living forms; the anthropological paradox of the animal origin and nature of man; the psychological paradox of the mechanical development of the mind, and its absolute dependence upon the brain and nervous system; the moral paradox of the dependence of the will; and, finally, the sociological paradox of the reign of fixed laws in society.

Such is a hasty survey of man's true relations to the world in which he is placed—a crude enumeration of the most general illusions, deceptions, and paradoxes of nature. But within each of these great groups there is a multitude of minor phenomena which all partake of the same general character.* Only so fast as appearances have been made to give way to realities, whether in the domain of physical, vital, or psychic laws, have mankind been able to make any material progress. Only when the same shall have been done in the domain of social laws, will social progress, except of the secular kind, be possible. Physical realities have, one by one, been stripped of their masks, and dragged before the light. Once caught, they have been tamed, trained, and put to man's service. To this alone is due all our brilliant material civilization. Vital laws have been gingerly invaded, but with proportionate results. Psychic laws have long received attention, but from so false a stand-point that little more than the natural results have been achieved. Morals have stood absolutely still, if they have not gone backward,† as the "moral science" writers admit, because the *appearance* of a *free* will has not yet given way to the *reality* of a *dependent* will. Social laws have received

* For other examples, see vol. ii, pp. 25, 473.

† The only sense in which this statement is not true is set forth in vol. ii, p. 507.

scarcely any attention, and, as a consequence, society as a whole has undergone no improvement, although the vastly disproportionate extent to which physical progress, due to the discovery of physical truth, has overlapped and overgrown it, makes the social stagnation another paradox to thousands who mistake material progress for social progress.

Now, every one admits that the practical use of science is its application to art. The application of science to art is only another way of expressing the utilization of the materials and forces of nature. By a knowledge of natural laws man is enabled to harmonize natural forces with human advantage. This truth, of course, must be general. It would be illogical to pretend that it applies to some kinds of natural laws and forces and not to others. What becomes, then, of *laissez faire?* Yet some who would be the first to grant the above premises, who are strongest in the conviction that society is the domain of regular laws, who are most earnest in their search for these laws, nevertheless, strangely enough, deprecate all attempts on the part of the agents of society to control the social forces and harmonize them with the social welfare. This is perhaps well enough, in so far as it may tend to check these attempts at this time, although such attempts are rather to be smiled at, as we smile at the plans of the would-be inventors of self-acting motors, were they not often so serious. But why lay so much stress on these crude failures at invention, due to the absence of science? Why point to them as permanent warnings against all future attempts to regulate society? Why cry "*Laissez faire!*" as if society would ever work out its own progress? As well say to all inventors: Cease trying to control nature, let it alone and it will control itself; it will, if left undisturbed, work out, in its own good time, all the cotton-gins, reaping-machines, printing-presses, and sand-blasts that are needed. Why not, because the first telegraph line and the first ocean cable failed, cry down the Wheatstones and the Fields, and say, Let these matters alone, they will regulate themselves?

In point of fact, there were many who did so exclaim, as my personal recollection of the last-named event attests; and, although they did not claim that nature would ever do these things itself, they insisted that they could never be done. But even this last is not an uncommon position on the sociological question. In the domain of physics and mechanics, of industry and commerce, we are accustomed to call such people "croakers" and "*retardataires.*" What shall we say of them in the field of social science? If society is to be benefited by the establishment of a social science, pray, how is it to be done, except by the same means that have rendered other sciences so useful? What would be thought of a successful experimenter in physics, should he constantly maintain that, while all the phenomena with which he dealt were uniform and governed by fixed laws, it was nevertheless useless to hope that they could ever be made more beneficial to man than nature, unaided, renders them, and should perpetually characterize all who attempted this as mere meddlers with the unchangeable laws of nature? Such a position would be pronounced highly inconsistent, in view of the actual benefits which man has derived from just such artificial and meddlesome control of physical forces, and of the fact that every successful experiment, whether useful to man or not, implies and involves such extra-natural modification.

The only way in which any science has ever done any practical service has been in enabling man, by the aid of the insight and foresight it has furnished him, to control the laws and forces which that science explains, and to bring them into harmony with his own wants. The social science can form no exception to this rule; it must come strictly within its scope and purview. But how shall the social forces be controlled but by society itself, and through its own chosen agents?

Let us admit, however, as candor dictates, that almost everything that has been said by the advocates of *laissez faire* about the evils of governmental interference is true, and that there is much more that has not been said which should be said on the same subject. Let us only take care not to admit the principle in its abstract essence, which is the only hope there is for the ultimate establishment of a teleological progress in society.

It is true that the laws of society are so deep and so occult that the present political rulers have only the vaguest conception of them; that sociological paradoxes are so common, nay, almost universal, that as a rule their supposed ingenious devices fail entirely or produce effects the reverse of those intended, and expose them to the merited rebukes of scarcely less deluded critics who unfairly judge them from these effects after they have taken place; yet, amid all this, the principle remains unshaken.

While there is a social statics, there is no statical condition of society. Just as the mechanical laws of equilibrium do not prevent the incessant motion and change of all things in the universe, so the establishment of the laws which tend to preserve society as it is does not alter the fact that society is in a state of incessant change. It is social dynamics, therefore, which, whatever may be its real importance compared with social statics, must always possess the chief interest in the science of sociology, as the end for which all other laws are studied and principles laid down.

The movements of society are various, and may be variously classified. There are changes in quantity and in quality, in position and in location. Population undergoes a thousand modifications. Customs, laws, governments, religions, industries, all change, disappear, and re-appear. Character and physical constitution also vary almost beyond limitation. On each of these peculiarities different classifications may be and have been based. But the fundamental classification, and that which, though not independent of these, lies below them and supports them all, is the distinction of progressive and non-progressive changes. In the course of this work rigid and unambiguous definitions of these terms will be introduced (vol. ii, pp. 108, 161), and this may therefore be here dispensed with. For the present we need only maintain that there is such a thing as a definite standard of human progressiveness, leaving the substantiation of that proposition for a future place.

Of retrogressive modifications little need be said. That they occur can not be denied, but whenever they do so it is always in strict accordance with the established laws of nature. The main drift, however, of social, and indeed of anthropological changes, has ever been and is still progressive, and it is with these that we have now chiefly to deal. These constitute the true field of social dynamics, and the legitimate aim of this science is to ascertain the laws of these changes. But knowledge would be useless if confined to the mere contemplation of truth. As M. Comte so justly remarks, all that distinguishes science from mere erudition is the power it affords of rendering knowledge useful by enabling us to predict, and thereby to prepare for and modify events and results.* If social dynamics is a true science, this is its chief aim. It should investigate the laws of human progress with a view to *influence* that progress for the good of society. But, according to our definition, hereafter to be more fully stated, to do this is simply to increase the rate of that progress.

Social progress as thus defined is capable of a still further subdivision into *passive*, or *negative*, and *active*, or *positive*.

Passive, or negative, progress contemplates the forces of society as operating in their natural freedom, subject only to the laws of evolution in general. Here society is regarded as passive in the sense of being simply acted upon by the forces that surround it and operate within it. It is conceived as negative from the absence of any force extraneous to these regular natural forces operating in the direction of their limitation or modification. Such, it is believed, has been the

* "Philosophie Positive," vol. ii, p. 20; vol. iii, pp. 8, 212.

nature of most of the progress thus far attained by society, as it is of all that which has taken place in the animal, vegetable, and inorganic kingdoms of nature.

Active, or positive, progress takes place through the application to the natural forces acting in and upon society of a force external to and distinct from them. To the regular course of the social phenomena as determined by the laws of evolution, we must conceive added a new force limiting and directing these into special channels and for special ends. Its chief quality as distinguished from other forces is *purpose.* In short, it is the teleological force, the abstract conception of which is familiar to all, having formed the basis of theological philosophy. Indeed, this element is by no means new as a factor in social dynamics. The pure processes of nature, conceived as unintelligent, have never been deemed sufficient to account for social phenomena. A teleological force has always been believed to preside over, control, limit, and direct the affairs of men to special progressive ends. No time need therefore be spent in endeavoring to define the nature of this force, it having already been closely woven into all our conceptions of social progress by theological teachings familiar to all. The only thing new about the idea under consideration is the *source* of this influence. The progress of our knowledge of nature has tended steadily in the direction of narrowing down the field of alleged teleological power, banishing it from each of the great provinces of nature—first, from the celestial realms, which are now presided over by the strictest mathematical laws, and then from the other fields of increasingly complex phenomena. And so great has been the success thus far, and so complete the proof of the possibility of genetic explanation where teleological explanation has so long been regarded necessary, that consistent minds, having no natural or hereditary bias, are ready to concede the probability that teleological influences must eventually be excluded from the whole domain of natural phenomena.

Nor must it be forgotten that the very idea of a teleological force is an anthropomorphic conception. But for the known power of man to modify nature to his own ends, no such power would have ever been ascribed to his divinities. And, although the reality of such an ascribed power be disproved by the light of scientific truth, the source of such a conception will still remain as an objective reality. It is this reality that it is sought here to recognize and rehabilitate, and to bring forward as the true active or positive force in social dynamics. No one can fail to perceive its identity with what has been already designated as *anthropo-teleology* (*supra*, p. 28), the power of man to modify and direct the forces of nature for his own purposes.* While this force was there applied generally to all the processes of nature and shown to constitute the chief element of the individual progress of mankind, its application is here limited to the natural laws of society, and it is proposed to show that to its general recognition will be due a renewed and greatly accelerated progressive movement in society.

This force is regarded as *active* by reason of its direct action upon the remaining forces controlling society, while progress thus produced may be fitly called *positive*, from the purely arbitrary character of its processes and the recognition of man himself as the disposer of social events. As, in individual action and enterprise, this force is the real cause of all invention, through which nearly all the material progress of the world has been effected, so it is claimed that, if society is admitted to be the theatre of natural forces in the

* The modifications of nature which follow science and which constitute art are twofold—objective or positive, and subjective or negative. In the first of these cases man adapts nature to his wants, in the second he adapts himself to nature's requirements. Thus, wherever it is possible, objective phenomena are modified and forced into channels advantageous to man. But where he has no direct control over phenomena, as, *e. g.*, the weather, he accomplishes the same purpose by modifying his own immediate surroundings, and adapting himself to conditions which he is unable to change, as by the invention of clothing, the construction of houses, etc.

same sense as the remaining departments of nature, there is no escaping the conclusion that the extension of the same force or influence to social phenomena may yield corresponding results. To deny this is to deny the parallelism of social and physical phenomena—*i. e.*, to deny the existence of a social science.

Let us insist once more, however, that *science* must precede *art*; that *discovery* must antedate *invention*. For, as already said, the cause of the failure of all attempts at invention in politics thus far has been ignorance of the laws of nature controlling human events. It must, therefore, be frankly admitted that, at the present stage of human knowledge, the great work to be done is the investigation of these laws. This is the province of sociology at the present infantile stage of the science, and too much praise can not be accorded those pioneers of this science who insist that we must not advance too rapidly, but must first assiduously apply ourselves to the task of collecting materials and supplying data for the future prosecution of the study of sociology. But it will not do to go so far as to assert that this passive or negative department constitutes the whole of that science. Were such the case, then would it be a plaything, and deserve to be classed along with the metaphysics of the middle ages, as a mere grindstone for the sharpening of human wits.

Social phenomena have been shown to be capable of various kinds of independent classification. The most important of these was stated to be that into progressive and non-progressive. Of progressive phenomena two general divisions were made—the one passive or negative, the other active or positive. The laws governing all these classes of social phenomena are of the utmost importance, and constitute the legitimate province of sociological study. But in all except the last-named subdivision pure science is involved, with no direct allusion to art. In the last-named subdivision, it is joined to the art of regulating society.

The science which concerns itself with the laws of the social *order* is social statics. That which considers the conditions of social *progress* is social dynamics. One branch of social dynamics confines itself to the normal changes going on in society under the sole influence of natural laws, and is strictly analogous to the dynamics of astronomy or physics. The study of this class of laws has no other object than that of mere *discovery*. It admits of no attempts to connect discovery with invention. But the other branch of social dynamics, that which embraces the influence of those active or positive forces heretofore described, necessarily connects the study of these forces with the *art* of applying them, which is a distinctly human process, and depends wholly on the action of man himself. This art may be very appropriately named *Sociocracy*,* although it is the same that has been sometimes called *politics*, giving to that term a much wider range than that now usually assigned to it. We have, therefore, besides social statics, negative and positive social dynamics, all of which classes are necessary to constitute sociology a true science.

It would be easy to show that any science possesses just these stages of development, and that, before it can become useful to man, the last or positive stage must be reached. By means of this alone can the principles of a science be applied to human uses—*i. e.*, to art. A science which can not be so applied is useless, and an acquaintance with its laws constitutes what Comte distinguishes as mere "erudition."

This should not, however, discourage the investigation of any department of nature whose immediate application to human needs can not be perceived. The history of discovery is too full of examples of the unexpected practical fruits of abstruse and apparently valueless researches, to warrant the prediction that any thing must necessarily be useless.

Again, there are many sciences, and sociology may be one, the precise manner of whose returns in direct benefit to the

* See "Penn Monthly," May, 1881, p. 336.

race is as yet very obscure, and in whose study the greatest efforts should be made to refrain from undue attempts to apply its principles before they have been established upon the most certain foundations. In such cases it is better to linger long and patiently at the statical and passively dynamical stages, and to understand thoroughly its positively dynamical principles, before venturing to point out the proper mode of their active application to art. But this is quite another thing from maintaining that these sciences admit of no such application, which is the absurd position of the *laissez faire* school of sociologists—absurd, since it involves a direct contradiction, and clearly concedes that no such science exists.

The problem, therefore, is one of method. The immediate question is, What measures are safe, what means certain to result in increasing the harmony and diminishing the discord between the phenomena of nature and the welfare of man?

In the discussion of all questions respecting the legitimate sphere of positive law, it must finally become recognized, as it has been in so many other questions in which abstract principles have once been defended, that no such principles exist, and that each special issue must be considered upon its own merits. Its advisability will depend upon its own special nature and upon the circumstances under which it must operate. Whether it will in reality prove more beneficial than injurious becomes in all cases a simple question of fact, and its adoption or rejection must always, as now, be due to the opinion of the legislator as to what are to be its effects. But this very admission only shows the immense importance of reducing legislation to a science as exact as possible. Experience must be organized and judicially weighed. History must be thoroughly understood, not only in its superficial bearings, but in its fundamental principles, as an index to human nature in general. But, above all, the laws manifested by the social forces (*infra*, p. 468), the first principles of social mechanics, must be drawn from the great "hierarchy" of simpler sciences upon which the social science rests, and theoretically mastered by the law-maker and the statesman.

There are already many minor questions of positive law, national control, and public intervention in social intercourse and private business affairs, which almost unconsciously have passed through the stage of discussion, been conceded by the *laissez faire* school, and adopted by society in many countries.* The advantages of the municipal control of the fire department in cities is so obvious that scarcely any one can be found to favor private companies. Postal affairs in some countries occupy nearly the same position. In a few countries the management of telegraph lines has with a feeble struggle passed out of private hands. Lines of passenger travel and freight transportation might be, no doubt, in many if not all cases, and have in some cases already been, advantageously transferred to the public charge. In Germany and the United States public instruction has been made in a great measure to supersede private instruction. In the former country it is compulsory, and is extended to a large percentage of the population. Few doubt that the general intelligence of the German people is vastly greater than it would be had education been left entirely to private enterprise. Even in the United States, where it is wholly optional with parents and students, though taxation for the purpose is obligatory on all, it will not be disputed that the people are more enlightened than they would be with none but private institutions of learning. Of the real benefits of public education, as of education itself, there are varying estimates. Of its efficiency and feasibility there can be no longer any doubt. And there are some who regard these effects as of the highest importance, and who believe that an extension of the amount of such instruction would be attended by proportionate results.

It may surprise some of the advocates of the let-alone

* See "Penn Monthly," May, 1881, p. 333.

policy to be informed that there are certain operations which have always been under state control. But such is the fact. For what is government but a system of control? It controls the finances, the public domain, the administration of justice (vol. ii, pp. 364, 391), defense of its boundaries, the intercourse with foreign countries, and a multitude of other matters. The fact that these have never been left to private enterprise does not prove that such might not be the case. A nation might leave its financial affairs to private individuals as well as its postal affairs.* The private banking system, which the state controls more or less as it sees fit, might be so far left to itself that the collection and disbursement of the public revenues would be performed by private banks, and the entire financial system placed in the hands of independent financiers. Suicidal as such a policy would obviously be, it can not be qualitatively distinguished from the like policy applied to the business of transporting crops, minerals, and manufactured goods from place to place for the purposes of distribution. The revenues of a nation do not belong to it any more than the products from which they are raised, and the state has as much right to control the management of the one as of the other. The only difference is that, from the specific nature of the two operations, one has always been regarded as legitimately under the control of the state, while the other has been thought to be most advantageously left to private enterprise. All the functions which the state habitually performs, even to those of war, might be similarly compared, and it would appear that government itself is simply a collection of cases in which society in its corporate capacity has assumed to control certain operations, and interfere with the unrestrained liberty of private enterprise.

In all those affairs which the state can manage more advantageously than the individual it has in fact managed well, and such as have passed from private to public control are

* Farming of revenues has, in fact, been extensively practiced.

better administered by the state than they were by the individual, while such as are in part administered by the state and in part by private parties are as a rule far better administered by the former. To this latter class pre-eminently belongs the work of popular instruction. This is not the place to introduce a full discussion of the superiority of public over private education, and for this the reader is referred to Chapter XIV. We may, however, anticipate the decision there reached that, whatever doubt may exist with reference to the propriety of state control of any other social process, there can be none with regard to education. But, if this be the case with what has heretofore gone by the name of education, it will be far more true still of that which we have sought to embody in that term. If there has been apparent failure or partial real failure, it has been due to the manifold imperfections of the systems denominated educational. When education shall imply a knowledge of nature, its universal extension must result in progress.

It is important, before fairly entering upon the subject-matter of this work, to indicate the stand-point from which whatever shall be stated will proceed. I have already briefly alluded to the two prevalent antagonistic types of mind, by which all questions concerning the universe, mankind, and society are always discussed. The chief difference in them is the point of view from which they respectively regard phenomena. One class sees everything as *being done*, the other as *doing*. One type of mind may be regarded as putting nature in a *passive*, the other in an *active*, attitude. A variety of antithetical terms have been invented for the purpose of clearly setting off these two great types of mind against each other. Few of these are wholly unobjectionable; none of them are sufficiently comprehensive to embrace all the points of distinction. The word *teleology* approaches more nearly to a complete expression of the conceptions of the one school than any other, but no equally satisfactory term has yet been found to convey the opposite idea. The word *genesis* would probably be the best yet discovered for this purpose, were it not preoccupied in a variety of other and special senses. The adjective *genetic* is less objectionable in this respect, and, where adjectives are required, *teleological* and *genetic* are probably on the whole the best. But, as even these fail to take in the whole scope of the conceptions, another pair, very useful in certain cases, has been proposed.* These are, *dualistic* and *monistic*. The idea here is, in the first, the separation of the motive power in nature from the phenomena, and, in the second, their union.

The term *positive*, used by Comte as the opposite of both *theological* and *metaphysical*, is both vague and ambiguous (*infra*, p. 85). The term *mechanical* is too apt to be confounded with what Herbert Spencer calls the "carpenter theory," and thus suits both the conceptions. Other expressions, many of them useful in certain applications, but all of them insufficient as general terms, need not be considered here, although they will be freely used when required in seeking to elucidate this deepest of conceptions for which there is an acknowledged dearth of words. In ordinary cases, however, the four terms teleological, dualistic, genetic, and monistic, will have to suffice, and their meaning may be extended by the reader beyond the limits prescribed by their etymology, and made to embrace all the accessory notions demanded by the context.

It is scarcely necessary to say that the stand-point from which the present work is written is the strictly monistic or genetic one, from which Nature and all her phenomena are conceived as the parts of one whole or unit, and bound together by an absolutely unbroken chain. For it is clear that only from such a stand-point, and only in harmony with such a conception, would it be of the least use to hope for the accomplishment of any results. Neither man individually nor

* Ernst Haeckel, "Schöpfungsgeschichte," S. 31, 67; "Anthropogenie," S. 12.

society collectively could ever take one certain step except actuated by this idea. However it may be in the domain of faith, in all real action this conception is and always has been the fundamental postulate. The invariability of nature's laws, the absolute dependence of all phenomena: these are the initial premises, the *sine qua non*, not only of all science and of all art, but of all action of whatever kind. And herein is the most complicated of paradoxes—that, while the intellect has been wedded to appearances and error, truth and reality have overruled the vagaries of the reason, and prevented it from leading the race to its own destruction (vol. ii, p. 287).

Instead of considering phenomena as the effects only of independent and arbitrary causes, as the teleologists do, or merely as phenomena wholly disconnected from the idea of cause or effect, as the positivists do, they will be regarded as both effects and causes, as terms in an infinite series of causation, deriving their own character from the immediate antecedents out of which they are evolved, and impressing that character upon the immediate consequents upon which their activities are expended. Dispensing with the agency of a *first* cause and of *final* causes, and calling in that of efficient causes only, all manifestations in nature must be regarded as the effects, on the one hand, of true causes (*causæ efficientes*), and as themselves such true causes, on the other. This conception is the only one by means of which any anthropoteleological results can be supposed capable of accomplishment, and without such results the limit of man's evolution, both individually and socially, must soon be reached. The law of population as set forth by Malthus,* which is at least true in the abstract, that whereas the means of subsistence increase in an arithmetical, population increases in a geometrical ratio, would be sufficient to teach us this, were there not a variety of other circumstances that with equal certainty

* "Essay on the Principle of Population," fifth edition, London, 1817, vol. i, pp. 9, 14.

point to the same result. The only hope of establishing, or for any great length of time maintaining, a condition of social dynamics is in the invention, by human foresight, and direct application to society itself, of such an anthropo-teleological plan or scheme as shall successfully neutralize these equilibrating forces, and give to the social organism, as it were, a new lease of life. But social progress means more than the mere maintenance of the social organism, just as individual life means more than the bare conservation of the bodily existence. No progress is real that does not constantly show a reduction of the aggregate suffering or an increase of the aggregate enjoyment throughout society (vol. ii, pp. 161, 174). This, no means thus far adopted have ever yet accomplished. Before concluding this introductory survey, therefore, it will be necessary to give a moment's attention to this, the really most important and practical of all the considerations to be discussed. A systematic analysis of this subject will be found in Chapters IX and X, but, as it is one that lies at the foundation of the whole work and modifies all its details, it should be constantly before the mind of the reader as he passes through the various chapters of the present volume, to certain portions of which its recollection will supply an explanation where, without it, the mere text might appear obscure.

The root-idea to which I will here confine myself is the true supremacy which must be accorded in any just system of philosophy to the *feelings* as the real *end* toward which all efforts designed to secure the advancement of society must be directed. Although it is upon the intellect that we can alone rely to secure such a control of the social forces as shall successfully harmonize them with human advantage, it is feeling that must be alone consulted in determining what constitutes such advantage. Every true system must regard intellect as the means and feeling as the end of all its operations. Intellect itself can only constitute an end in so far as it is itself a seat of feeling; and, while intellectual enjoyment is sure to constitute a progressively larger proportion of the sum of all enjoyment as it itself develops, it is in point of fact at the present time, even among the most advanced races, a very minute fraction of it, and must continue to remain so for a great while. This fact must be recognized and appreciated, or there will be great danger of mistaking the means for the end. It is nevertheless true that, before any direct measures bearing upon this end can be entered upon, a large amount of preliminary work must be first laid out in the perfection of the means, just as, before any great direct results can be attained in any other field of science, as for example in astronomy, the means of prosecuting the necessary undertakings—that is, the instruments by which natural forces are to be controlled, directed, and intensified—must first have been brought to a certain high state of delicacy and perfection. Now, the intellect is the general means of exploitation in the great field of sociology, and it, together with the more special means or instruments by which it must operate, such as education, schools, laboratories, museums, etc., must first reach a certain degree of perfection, before the practical labor of engineering the social forces can be fairly entered upon. The present humble effort, therefore, so far from claiming to attack the problems of sociology itself, is simply an appeal to mankind to sharpen up their tools for the work, to set about the task of procuring the primary means for entering upon the campaign.

The practical work which sociology demands is, when reduced to its lowest terms, *the organization of feeling.* The human body is a reservoir of feeling which, when wholly unobstructed, is all pleasurable. There are wide degrees of difference both in the quantity and the quality of this feeling. It has its volume, pitch, and *timbre.* The height to which enjoyment might be carried is very great, and can not yet be reduced to any standard of measurement. Like everything else in nature, feeling is the constant play of external forces which are perpetually buffeting against it.

Checked in its natural flow it becomes pain, and this negative class of feeling, too, has all the degrees which belong to the positive or pleasurable class. The special problem of sociology is to control these forces, to remove throughout its vast domain all those which obstruct the natural course of the feelings, to increase and intensify those which are favorable to that course, and to guard against any form of stimulation whose reaction will count more strongly against the general sum of human happiness than the stimulus itself counts in its favor.

Such is the barest outline of the real problem with which the social science must expect to grapple, so soon as it shall have secured the means by which alone it can successfully commence operations.

One other point may be briefly touched upon here, to be fully drawn out hereafter (vol. ii, pp. 472, 487), the reasons for doing so being substantially the same as those given in the case of the point just disposed of. This is the important distinction which it is necessary to make between *intellect* and *knowledge*. Intellect alone is wholly untrustworthy. It matters not how vigorous, brilliant, or profound it may be, it is unsafe when left to itself. The various metaphysical and scholastic systems of philosophy, so totally barren of practical results, are the sufficient proofs of this truth. To be of the least value, intellectual activity must be coupled with knowledge. Knowledge is simply objective truth comprehended by the intellect. Truth is the natural nourishment of the mind, and, when not fed by it, the mind becomes superficial and impotent. When nourished by unnatural food, such as pure theory, internal reflection, imagination, or fancy, the mind is not only impoverished, but it becomes deranged and delirious. It flies off into the empty realms of speculation, fanaticism, and mysticism, and builds up airy systems which hold out large promise to the plodding masses who have neither time nor power to think, and who follow on to their ultimate ruin. The world, it is to be hoped, has at last fairly learned the lesson that nothing short of stern objective realities can constitute a safe foundation for any future moral or social system.

Tangible facts; material objects; truths, laws, and principles, demonstrable either directly by the senses or deducible from such as are demonstrable, in such a manner that their negation is absolutely excluded—such are the materials for the intellect to deal with, such the proper objects of knowledge. The only safe knowledge is knowledge of *things*. Knowledge of *thoughts* is unreliable, because thoughts themselves as often consist in errors as in truths. The only real knowledge is knowledge of *nature*. The only important knowledge is science. Not to limit the range of man's attainments, for knowledge of anything may be acquired *as* science, and no knowledge which is not capable of reduction to a place in the category of science can be considered as knowledge at all.

But, again, there are degrees of importance in the manifold forms of true knowledge, a fact which will require the most thorough consideration at the proper time (vol. ii, pp. 495, 619), but which can only be mentioned here, to avoid any possible misunderstanding upon that point.

The particular end here aimed at is the distinction between *intellect*, the bare capacity for knowledge, and *intelligence*, which implies that the intellect has been provided with the proper materials for its successful operation as an agent of civilization.

This knowledge can only be imparted to great masses of men by means of the systematic education of the young. It is, however, easy to adopt what seems to be such a system, but which utterly fails to accomplish the object which civilization demands, viz., the improvement of society. Education should be valued in proportion as it gives its possessor correct views of life, of his relations to society and to nature—*i. e.*, as it improves the *moral tone* of mankind. The speculations of the intellect, unsupplied with facts, have no influence in this direction. Neither do those forms of education which go by the name of *erudition* or *culture* do this to any marked extent. I would not discourage the discipline and refinement of the intellect or the cultivation of the æsthetic faculty. "These ought ye to have done, and not to leave the other undone." Mere culture, while it is in itself an element of human happiness, is at the same time wholly non-progressive. It is not a form of knowledge. It has no effect on action, and exerts no influence on character. It should be made secondary, and enter into education only after, or as additional to, the inculcation of truth. The system of education which makes art take precedence over science, and culture over knowledge, is a perverted system which, at best, only leaves the world where it finds it.

The progress to which dynamic sociology points is an *artificial* progress. To some this may sound strange. Associated with the word artificial are certain vague and confused ideas. Whatever is artificial is assumed to be in some way inferior to that which is natural. Such ideas need to be corrected. It is generally true that in the fine arts the aim is to imitate nature, but it is also true that even here art often surpasses nature. In the domain of practical art, however, the case is quite different. Here all progress in art is directly away from nature. The successful in this field is not that which most closely imitates nature, but that which most completely alters it and bends it to the advantage of man. Useful art is a departure from, and improvement upon, nature. It is therefore important to gain a clear conception of the distinction between natural and artificial progress.*

* It is proper to remark respecting the discussion which follows, and the important principles therein set forth, which are frequently applied throughout the entire work, that up to the date of its completion, in July, 1880, I had neglected to acquaint myself with the Duke of Argyll's (in many respects) remarkable book, "The Reign of Law." Supposing him to be a follower of Adam Smith, and, as the title of the work would naturally lead one to expect, a theoretical political economist and advocate of the competitive system, *laissez*

All progress is brought about by *adaptation.* Whatever view we may take of the cause of progress, it must be the result of a correspondence between the organism and the changed environment. This, in its widest sense, is adaptation. But adaptation is of two kinds: One form of adaptation is *passive* or *consensual*, the other form is *active* or *previsional.* The former represents *natural* progress, the latter *artificial* progress. The former results in a *growth*, the latter in a *manufacture.* The one is the *genetic* process, the other the *teleological* process. In passive adaptation the means and the end are in immediate proximity, the variation takes place by infinitesimal differences; it is a process of *differentiation.* In active adaptation, on the contrary, the end is remote from the means; the latter are adjusted to secure the former by the exercise of *foresight.* It is a process of *calculation.*

faire doctrine, and naturistic policy, I had not hoped to find anything new to repay its perusal. A friend having pointed out to me the coincidence between certain of my views and those maintained in that work, I have hastened to repair this omission, and correct my mistake. The enlightened and all-sided tone which pervades the greater part of this treatise is highly refreshing, and, would space permit, I would gladly introduce a more extended exposition of the Duke of Argyll's views. As it is, I can only point out that, in a way of his own, the analogy between legislation and invention, and the law of attractive legislation, are quite distinctly enunciated, while, under the terms "Natural Law" and "Positive Institution," he has foreshadowed the distinction between genetic and teleological methods in the domain of politics. With regard to this latter principle, however, so feeble is his grasp of it, that, after having formulated it with some clearness, he immediately loses it in the following paragraph: "They [men] were right when they regarded their own faculty of contrivance as the nearest and truest analogy by which the constitution of the universe can be conceived and its order understood" (p. 390). This is not surprising, when it is remembered that throughout the first six chapters his chief aim seems to be to show design in nature, and to prove the existence of "contrivance" in natural phenomena identical with that exhibited by human agency. In a word, "The Reign of Law" seeks to establish the co-existence of theo-teleology with anthropo-teleology. It is through the rejection of the former rather than through the recognition of the latter that philosophy can reach solid ground, since the only alternative to theo-teleology is the genetic method. In failing to grasp this truth, the Duke of Argyll seems to have studied the "Origin of Species" quite in vain.

In order properly to estimate the superiority of active over passive adaptation, and the advantage of teleological or artificial over genetic or natural progress, we need first to consider the nature of the latter and the obstacles with which it perpetually meets. In the first place, it necessarily involves enormous *waste.* The proximity of the means to the end forbids the taking advantage of the forces in operation, destroys the *leverage* by which effects are rendered disproportionate to causes. The higher we rise in the scale of being, the greater is the disproportion between causes and their effects in producing further progress. This may be seen in the increased length of the strides that animals and plants have made as they have risen in the scale of organization, until at last we find the slightest differences in the brain-structure producing the enormous differences which distinguish men from animals and sages from cretins. This becomes still more apparent in the progress of human civilization, where apparently simple mechanical devices have exerted such immense influence on the condition of mankind and on the physical state of the earth's surface.

The principle which underlies these truths is that, as organization progresses, the genetic gradually gives way to the teleological method, the means separate more and more widely from the end, and the amount of *purchase* or *leverage* is correspondingly increased. The secret of the success of the mind-force in nature is not its greater mechanical strength, but its peculiar faculty of applying itself to the long end of the lever, and thus gaining an immense advantage over all the counter-forces of inertia, resistance, etc., to be overcome. The same principle, on the other hand, equally accounts for the enormous waste which not progress alone but existence itself entails in the case of all organisms as products of natural development. The terms *natural selection* and *survival of the fittest*, tersely as they express the great law of passive adaptation, both contain the significant implication that the great bulk of things are not selected, that only the *select* few, who happen to prove *fit*, *survive*. All else perishes. I need not refer to the still more shocking waste of germs which throughout all organic life accompanies the process of perpetuating the species. Society itself offers unlimited examples of this truth. It is still in the main a prey to this wasteful, passive adaptation. Cities grow up without the least premonition of their future greatness, and require numerous expensive re-adjustments to meet what a little foresight might have provided for at the outset. The first pioneers of a new country destroy the forests, and leave to the dense population which is to rise an uninhabitable desert. The soil of the richest regions of the globe is exhausted in the first few years of occupancy, in consequence of the same improvident policy. Enormous losses are incurred by redundant transportation. Free trade is the impersonation of the genetic or developmental process in nature. Heavy metals are mined on one side of the globe, transported in a raw condition to the opposite side, manufactured there, and then re-transported as manufactured articles to the place where they were taken from the earth, to be consumed, perhaps, by the very people who mined them. And all this when there was no lack of natural facilities, skilled artisans, or thrifty capitalists in the immediate vicinity of the original resources. Some claim that this involves no loss, that it must be an advantage, else the laws of trade would not require it. As well maintain that the bringing forth by the oyster of its two million embryos, only a few hundred of which can survive under the most favorable circumstances, must be economical because they are produced under the operation of strictly natural laws.

The prodigality of nature is now a well-understood truth in biology, and one that every sociologist and every statesman should not only understand but be able to apply to society, which is still under the complete dominion of these same wasteful laws. No true economy is ever attained until intellectual foresight is brought to bear upon social phenomena. Teleological adaptation is the only economical adaptation.

One of the chief causes of the slow and secular character of social progress is the fact that, in a variety of ways, under the operation of genetic laws, it tends to defeat itself. A few of these ways may be mentioned here, merely as illustrations.*

All genetic progress is accomplished by rhythmical ebbs and flows. This involves incalculable waste. Only a small part of what is gained by the flood-tide is retained after the ebb-tide is over. The perpetual strife between the party of progress and the party of order carries both to ruinous extremes. The former becomes the party of excessive construction, building more than can be occupied; the latter becomes the party of destruction, demolishing the useful and the useless alike. Thus the cost of a little real progress is rendered enormous.

This same rhythm takes place in physical phenomena, making rivers crooked, the surface of the earth irregular, and the distribution of climate and other habitable conditions unequal. The efforts of man artificially to influence such physical phenomena to his advantage are always in the direction of diminishing the intensity of this rhythm. He aims to *regulate* the natural forces. Whatever success he has achieved has been of this kind, and but for such success he could not inhabit this planet as he does. Social phenomena, however, are still allowed to continue their wide fluctuations, and devastate the accumulations of ages. And some imagine that this is the true way to progress, and laud the advantages of extreme parties as calculated to "hold each other in check," when in reality their normal effect is to aggravate the asperities of the situation and increase the force, both of the forward and of the backward movement.†

* For additional instances, see vol. ii, pp. 71–73.

† Professor C. S. Peirce, in "Popular Science Monthly," vol. xiii, p. 476; Professor Joseph Le Conte, "Address before the Chitchat Club of San Francisco, 1878," *loc. cit.*, p. 100.

Another of the misfortunes of human progress is that, in all departments of knowledge, the human mind and the conditions surrounding it require that the study of phenomena be commenced from the top, and that the superficial view be taken before the fundamental view can be gained. Thus not only do we find men first occupied with the problems of sociology, the highest and most complex of the sciences, but in each more simple science, as in biology, the superficial and obvious are first studied and innumerable errors formed before the more profound and recondite problems are undertaken by whose solution alone true conceptions are attainable. How great, for example, have been the error and confusion to which the study of the most highly organized living beings has led before that of the simpler beginnings of life was commenced, which alone can yield the primary principles of organic existence!

Again, moral and social science labor under difficulties from which all other sciences are exempt. While in the physical sciences every attempt to go back to fundamental principles is deemed highly proper and praiseworthy, the original truths upon which society and morality rest can not be laid bare and plainly stated for fear of shocking the morbid sense of the civilized world. To do so would be to call down a storm of indignation from the majority of mankind. This denunciation is no less effective because irrational. Those who use it thereby show that they have no grounded conception of the origin of society or the bases of human action. The foremost thinkers are, therefore, obliged to refrain from promulgating the real truths that underlie society and conduct, through fear of actually obstructing the progress of the world. A wise man has declared that "the greatest intellectual benefactors of mankind have never dared, and dare not now, to utter the whole of their thought." * But this timidity is usually due to a truly philosophical fear of jeopardizing the very cause which they

* C. S. Peirce, in "Popular Science Monthly," vol. xii, p. 13.

hold most dear. The impolitic class of theoretical reformers who have the habit of charging such people with moral cowardice, are themselves only fit to lead a forlorn hope, and frequently thereby engender a deplorable reaction.

There is scarcely an important principle of sociology which has not shocked the sense of the age and been met with condemnation as calculated to upturn the established order. The primary laws of human action, upon which both social and moral science rest, can not be stated in the simple language of science. The objection that the explanation is too simple to be true, which is often made in the less involved sciences,* is particularly apt to be made in these most involved sciences. Men do not want to know that their life is capable of analysis into simple physical principles. They prefer to contemplate themselves as something entirely preternatural. The science of human conduct is particularly objectionable. Every rational analysis of human action tends to ground it in egoism and assimilate it to animal action. Very few want to know such truths. That the most disinterested action should result from the effort of the actor to experience pleasure is a truth repugnant to the cultured mind. It belongs to the list of unwelcome truths, like that of the genetic development of the race from a less highly organized state.†

And thus is social progress thwarted at every step. The various institutions established in society are hedged about with a sanctity which it would be sacrilege to invade. To show how they originated, or even to assert that they have had an origin in the nature of things, is a task which only brave minds will undertake, and that with little hope of convincing any body.

These, we say, are among the obstacles which the science of sociology has to encounter beyond all that lies in the path

* Haeckel, "Anthropogenie," S. 109.

† Sir Charles Lyell, "Principles of Geology," vol. ii, p. 501; Professor C. S. Peirce, in "Popular Science Monthly," vol. xiii, p. 477.

of the other sciences. And, if other sciences have sometimes been similarly hampered to a limited degree, it has only been in proportion as it was vaguely apprehended that similar explanations might thereby be made easier of the more complex phenomena of life, mind, and action.

Among other means by which progress defeats itself is the circumstance that all the labor performed in the interest of progress is unremunerative. Most of the labor incident to scientific discovery has to be done gratuitously, as it commands no price. In fact, much of it has to encounter strong opposition, so that there have even been martyrs to science. The utterance of progressive ideas is not welcomed, much less paid for. The lucrative employments are all non-progressive. Those receive most who labor solely for the maintenance of the existing *status*, such as lawyers, judges, officers of government; and, in civil life, merchants and various non-producing professions. In the literary world the only writers that are paid are those who describe things as they are, and the more superficial and trivial the subject written upon the greater the compensation. Those who are able to tell us how things were in the remote past, how they are to be in the remote future, or how they should be in the present—these must work for nothing, and meet with perpetual opposition besides.

The three classes who have made all the contributions to the world's advancement have thus performed only a "labor of love." These are the mechanical inventor, the scientific discoverer, and the philosophic thinker. With regard to inventors, all know how unfortunate their personal history has usually been. To die in poverty, though often living to see the fruits of their brain enrich others having more practical shrewdness, is too often the lot of this most useful class of men. The same is often also true of the scientific discoverer, but the greatest results that have been achieved by this class have come from men of leisure and of means, who were wholly free from embarrassment by the *res augustæ domi*, a fact which militates powerfully against the oft-made claim that great success is most likely to come from hardship and opposition. The great thinkers of the world have shared about equally the two conditions just described, which are respectively well represented by Francis Bacon and Auguste Comte. But in all these cases, and almost without exception, the grand progressive achievements of human history have been wholly without pecuniary reward to the persons who have accomplished them. And there seems no help for this state of things.

The reformer necessarily labors in an untried field. His principles are in fact often unsound, and, however sound, they are always mistrusted. Success is the only commodity that commands a price. But the inventor, the discoverer, and the thinker work not for the present, but for the future. They rarely hope that their efforts will be crowned with practical success during their own lives. How, then, can they look for material reward? They do not, and it can not be seriously complained that it is not conferred. It is not to complain that these facts are here brought forward, but rather to show that in the very nature of things all human progress, so long as spontaneous or genetic, *i. e.*, so long as not teleological, must operate to its own greatest disadvantage, and perpetually defeat itself.

Modern society is in such a state that not only is it the worthless that commands the pay, but the truly valuable is systematically kept out of view. Those having the least merits have the most love of applause. It is sufficient to make one believe in the alleged degeneracy of the times to see the zeal for "cheap notoriety" evinced by persons having no merits, and the willingness of society at large, through the press and in other ways, to co-operate in the work. The really meritorious person shrinks from notoriety, and scorns applause not rendered to merit alone. Yet merit is rarely sufficiently appreciated to secure its own public mention. It has, therefore, come to be a tolerably safe inference, whenever such public mention is made, to assume that it has been directly or indirectly *procured* by the party complimented. Such a state of things makes merit take precautions against being put forward by appreciative friends, lest the manner of the commendation be misunderstood, and the belief be entertained that it had stooped to advertise itself. In this way the true condition of society is not only never known, but what is precisely the reverse of its true condition is publicly believed to exist. The light portion, representing mediocrity, is bolstered up and kept prominently conspicuous, while the serious and solid portion willingly aids the former in keeping itself constantly out of view.

Human progress is further defeated by man's ignorance of his own interests. Those who most strenuously oppose measures of reform are usually the ones who would be most benefited by their adoption. Just as the slave often declares his preference for slavery and helps his master to rivet his chains, so the ignorant generally denounce intelligence, and do all in their power to prevent the light from reaching them. It is a paradox in matters of education that those who vote against it thus really prove their need of it. The unlettered man of large family whose children might, by the laws of many localities, be educated at the expense of the rich man of small family, is usually found joining with the latter to destroy this precious advantage. The laboring masses follow after designing demagogues, who promise impossibilities, to secure personal gain. They reject the wiser counsel of their real friends, who place less stress upon them from fear of being suspected of self-seeking. And so it is throughout; so that the philosopher often finds himself wondering how any progress can take place at all when every thing seems to conspire to make bad worse. And, in fact, whatever advance is made is due to "natural selection," and is in one sense the result of chance. Only progressive or at most stationary societies can survive. All others (and they may have been many) have disappeared. The most that can be said is that society exists because it is not retrogressive. And this explains in the only scientific way why it is progressive.

But it is only of genetic or passive progress that we have spoken, for, unfortunately, this is about all that has thus far taken place. The era of teleological or artificial progress has not yet begun. It may never begin, but, until it does so, society is as liable to succumb to an adverse wave of reaction, and suffer extinction, as is any race or species of animals or plants; and we know that this is constantly occurring.

To overcome these manifold hindrances to human progress, to check this enormous waste of resources, to calm these rhythmic billows of hyper-action and reaction, to secure the rational adaptation of means to remote ends, to prevent the natural forces from clashing with the human feelings, to make the current of physical phenomena flow in the channels of human advantage—these are some of the tasks which belong to the great art which forms the final or active department of the science of society—this, in brief, is DYNAMIC SOCIOLOGY. "*Voir pour prévoir*"; * "*prévoyance, d'où action,*" † *i. e.*, predict in order to control, such is the logical history and process of all science; and, if sociology is a science, such must be its destiny and its legitimate function.

* Comte, "Philosophie Positive," vol. vi, p. 618.

† *Loc. cit.*, vol. i, p. 51. The passage from which this last citation is made ought to be quoted entire, and deserves a place in the anthology of science. It is: "*Science, d'où prévoyance; prévoyance, d'où action:* telle est la formule très-simple qui exprime, d'une manière exacte, la relation générale de la *science* et de l'*art*, en prenant ces deux expressions dans leur acception totale."

CHAPTER I.

BRIEF SURVEY OF THE POSITIVE PHILOSOPHY OF AUGUSTE COMTE.

Anomalous character of Comte's philosophy—Nature of his errors—His style verbose—Comte the founder of Sociology—Sense in which he employed the term "positive"—His law of the progress of human thought, through the theological and metaphysical, to the positive stage—In what positivism differs from the scientific method—Comte's hostility to all causes—His "primordial problems"—His review of the history of civilization—The theological stage—The metaphysical stage—The positive stage—Comte's hierarchy of the sciences—Three kinds of observation—Tests of the position of the sciences in the hierarchy—Scientific prevision—Mathematics—Astronomy—Physics—Chemistry—Biology — Transcendental biology—Sociology—Social order and progress—The human race a perpetual individual —Social statics—Social dynamics—Positive education—Comte's scientific priesthood.

The works of Auguste Comte occupy an anomalous position in the history of philosophy. They may be briefly described in their *ensemble* as embodying, in the exposition of a fundamental truth, the greatest possible number of only less fundamental errors. The essential groundwork of all his reasoning is not only sound and progressive, but it is also, in the main, at least as far as concerns terminology and mode of presentation, new. However many previous writers may have caught glimpses of his philosophy, and however often his fundamental tenets may have found utterance under different circumstances and at different times and places before him, it still remains true that no one, prior to his time, had appropriated his method, and history will probably bear out his own assertion * that, in point of fact, no one before him can be justly said to have conceived the Positive Philosophy. True, as he himself admits, this philosophy, as a fact in human history, had long existed in the world, and had ever been the rival of the two great opposing philosophies, the theological and the metaphysical; and the period is assigned by him when it may be said to have fairly assumed the supremacy † as a principle of human action; but, objectively considered, it is none the less true that, not until long after it had openly asserted itself as the mainspring of scientific progress in the world, did there rise up a philosopher to comprehend its true nature and relations, and to give it a name. As the claimant of this great honor, Auguste Comte has never had, and never can have, a contestant.

But it is the misfortune of all truly great minds to be wedded to errors as well as to truths. In most cases the latter so far prevail over the former as wholly to eclipse them as soon as the sun of historical criticism fairly rises upon their lives. Usually, too, their errors are of minor moment, and are, therefore, soon forgotten. Generally, they are few in number and unobtrusive, and not unfrequently is the attachment shown to them of a more or less equivocal character. Not so with those of Auguste Comte. His are both numerous and obtrusive; they are of the gravest character, and are adhered to in his writings with all the pertinacity, emphasis, and iteration to which the French language is capable of giving vigorous expression. For this reason the writings of Comte have been slow in making an impression upon human thought. They are voluminous, verbose, and unattractive in their style; and nothing short of a persistent following out of the argument to the end can give the reader the ability to appreciate fully the magnitude of the theme

* "Philosophie Positive" (third edition, Paris, 1869), vol. ii, p. 436; vol. vi, p. 458.

† About the middle of the sixteenth century ("Philosophie Positive," vol. i, pp. 19, 20; vol. vi, p. 429).

or the "*solidarity*" of the great body of truths which the author actually marshals with the most rigorous logic. The result is, that the general reader has either not read them at all, and has derived his ideas of them from those who have only glanced at them, or else he has himself only casually looked them through, dwelling longest where the language is most emphatic, which is usually where some favorite untruth is being defended.

The general result is, that the works of Comte, where known at all, are for the most part unfavorably known, only a few having followed him through with their attention constantly directed to the general argument, and disregarding the erratic course of the author in adducing untenable auxiliaries, which are for the most part unnecessary, in support of it. That the popular verdict upon the case is unjust, may be safely assumed from the array of eminent names that have been permitted to be used as more or less unequivocally favoring Comte's general scheme. Among these may be mentioned those of Alexander von Humboldt, Baron Fourier, De Blainville, Poinsot, Navier, Broussais, Esquirol, Binet,* and others, at the time when he was delivering his course in public; while in recent times a no less eminent man than the late M. Littré has not only given in his adhesion to the Positive Philosophy, but has edited the new edition of Comte's works, and written an extended indorsement of them in the form of what he boldly styles the "Préface d'un Disciple."

The general influence of Comte's writings is, moreover, beginning to make itself strongly felt in France, not only by the spread of his moral and religious doctrines as set forth in his later speculations, but more especially in scientific circles, where the eminently practical character of the Positive Philosophy is commending itself to many well-known men of science, and may be seen as a silent power in national scientific assemblies.

* "Philosophic Positive," vol. i, p. 3.

It is as the unquestioned founder of the modern and as yet scarcely fledged science of sociology, the name itself of which was first employed * by M. Comte, that a brief exposition of his system and of the Positive Philosophy itself, also founded by him, requires a place in this work.

Notwithstanding the attempts that are constantly being made, wherever it becomes appropriate to refer to the Positive Philosophy, to define the term *positive* in that connection, and notwithstanding the acknowledged ability of many of those making these attempts, and the fact that they are not generally open to the charge of incorrectness, it is nevertheless true that very few persons, who have not carefully followed Comte in his own works and paid special attention to this chief characteristic of them, have acquired an adequate comprehension of the true meaning and scope of this term as he himself has employed it. While it is not untrue that the leading notion of the word in the Comtean sense is contained in, and conveyed by, the word *phenomena*, and that the general idea of the Positive Philosophy is the study of phenomena, wholly apart from both essence and cause, still this bald and technical form of definition falls far short of conveying to the ordinary intellect the intensely active and living idea which these terms excited in the author's mind, and which animate every page of that Koran of positivism, the "Philosophie Positive." Comte nowhere undertakes a formal definition of the term *positive*, and indeed the sense in which he applies it seems to agree so nearly with the popular acceptation that he perhaps thought it required none. This meaning, too, singularly enough, is in substantial harmony with the etymological one. Derived from the passive root of the Latin word *put* or *place* (*ponere*), whatever may be called *positive* must have been placed in a definite *position*. The intensive notion that this position is absolute or immovable is no more than frequently attaches to words seeking

* "Philosophie Positive," vol. iv, p. 185.

definite signification in derivative languages. In popular language this notion is conveyed by emphasis, and, as it always accompanies this word, it becomes of itself an emphatic word. It is never used by common people except in an emphatic sense and with a special stress of voice. The philosophical application of the term simply continues the intensive idea, without requiring any emphasis in its utterance. The exact idea, then, of "positive," in the true Comtean sense, is merely that which is *fixed* or established as certain truth. It is the *real*, the known, the tangible or sensible in nature. The positive may be briefly defined as that which really exists, that which is *positively* true—what *is*. It will be seen, therefore, that it does not differ from the scientific idea as commonly understood. Indeed, Comte employs the term *scientific* as a synonym of *positive*. Starting from the Cartesian idea of self as the only judge of truth, it assumes that there is something present when the senses so report; and, not stopping to discuss the correspondence of that something with the report thus made of it, the positive philosophy confines its investigations to these sense-reports which alone can be known. The sum total of these reports to the senses constitutes what are called phenomena, and with these and these only the positive philosophy deals. This, again, is simply the method of science.

The two great antagonistic and rival philosophies with which the positive philosophy has always had to contend are theology and metaphysics. The former is chiefly distinguished by the introduction of *causes*, the latter by that of *entities*, into all forms of speculation. The essential vice of both, according to Comte, is that of attempting to *account* for things. Unwilling to regard the phenomena of the universe as the true matter, in and of itself, for mankind to study, these earlier and less experienced philosophies have perpetually wasted their energies in the vain search after the causes of phenomena on the one hand and their substance or *substratum* on the other. The investigations of the theological school have been *teleological*, those of the metaphysical school, *ontological*. But, as the individual is cut off by his very constitution from all access to either of these fields of thought, it follows that all the efforts expended in these directions have been absolutely wasted. The only field remaining, the field of phenomena, on the contrary, is found to yield rich and valuable results wherever human research has been directed to it. All that has been gained toward the elevation of society and toward securing the comforts and enjoyments of life has come from this source, not one item having ever been contributed to the material prosperity of the world from either teleological or ontological researches.

The essential accuracy of all this, in both its historical and its dogmatical character, can not now be doubted, and, both for the fact and for the form of its presentation, the world owes to Auguste Comte a debt of gratitude which its long neglect and tardy acknowledgment of his writings have poorly repaid.

Thus far the positive philosophy has been shown to be little more than a formal expression of the scientific method as recognized by the ablest men of our day, and it is hoped that the term may be preserved as a synonym for that method, and as a valuable contribution to the terminology of those ideas which are so rapidly advancing as almost to render all language obsolete or inexact. But any account of the positive philosophy as founded by M. Comte, and as still adhered to by his faithful disciples, would be quite incomplete if nothing were said of an important peculiarity which has not thus far been mentioned, and which may be regarded as all that really distinguishes it from the simple method which all science must adopt. It has already been remarked that, as against the theological school, M. Comte repudiates all attempts to determine the causes of phenomena. But theology busies itself solely about arbitrary causes, each of which is original and independent, while all are supposed to proceed from the divine agent, and to aim at the accomplishment of preconceived ideal results. Each may therefore be regarded both as a *first cause* and as a *final cause.* One might suppose that it would have been sufficient, for the purpose of antagonizing the theological philosophy, to repudiate and disclaim such causes as alone concern theology. The readers of Comte had at least the right to expect that he would distinguish between *causæ finales* and *causæ efficientes*, and that, in case there were valid reasons for rejecting the latter, he would state those reasons. They are, however, doomed to the remarkable disappointment of nowhere finding any such distinction mentioned, while both classes of causes are perpetually assailed in one common strain of denunciation, and consigned to the, with Comte, exceedingly long list of "profoundly vicious hypotheses."

While, to the mind of all other philosophers, the arbitrary, original, and the final cause stand in the plainest contrast with the necessary, efficient, or mechanical cause, the former being, as Comte justly asserts, the basis of all theological reasoning, while the latter seems the almost indispensable postulate of science itself, he fails utterly to perceive any difference between them, and is found attacking with equal vehemence conclusions flowing from the one and from the other class. Now, even were these attacks, where necessary causes are involved, ever so much deserved, it is at least a manifest injustice to lay these latter to the charge of theology, and against this theologians have a just right to remonstrate, while all attempts to explain the Comtean philosophy should contain an honorable vindication of the theological school from so unjust an imputation.

This remarkable fallacy which pervades the entire philosophy of Comte, this confusion of two things so wholly different and even antagonistic, can only be accounted for as intentional, and it seems probable that, as he could find no valid argument comporting with his system by which he could assail efficient causes, although odious to his eminently practical mind, he found it convenient to embrace all causes under one general head, declare them theological fictions, and dispatch them all together. The narrow straits into which this plan so frequently led him are familiar even to casual readers, and yet only in a very few cases can he be charged with inconsistency in endeavoring to escape the meshes of his own net. He seems to prefer to battle on that questionable ground with the prevailing current of the thought of his own day, at the risk of making himself ridiculous in the next generation.

Among the necessary consequences of so singular a course may be mentioned his repeated discouragement of all attempts at *explanation*. What the phenomena themselves, subjected to the proper scientific tests, do not yield, may be taken as beyond the reach of human inquiry. It is only those who are affected either with the theological or the metaphysical bias or spirit that will waste their time and energy in the vain effort to fathom the mysteries that lie behind phenomena. He seems to have scarcely the remotest conception of the great principle, which even Bacon recognized,* that the most important phenomena of Nature lie deep-hidden within her and are not seen by the average observer (vol. i, pp. 45–52), but that it is only as guided by apparent phenomena, as effects, that the true investigator is led back into the region of those deeper ones which stand to the superficial ones in the relation of efficient causes.

As a further and necessary consequence of this obstinate blindness, we find Comte multiplying the number of what he calls "primordial" problems beyond the limits of finite powers, impossible for man ever to solve, and fit subjects only for the labors of theologians and metaphysicians.

* "Ædificium autem hujus universi structura sua, intellectui humano contemplanti, instar labyrinthi est; ubi tot ambigua viarum, tam fallaces rerum et signorum similitudines, tam obliquæ et implexæ naturarum spiræ et nodi, undequaque se ostendunt."—("Instauratio Magna," Præfatio.)

Among these it is amusing to notice quite a number which were actually solved during Comte's own life-time. For example, he repeatedly asserts that the chemical constitutions of the heavenly bodies belong to this class of insoluble problems; yet, even while he wrote, Kirchoff and Fraunhofer were collecting from the sun and the stars the evidence of their composition.

Among the most lamentable of Comte's vagaries, arising out of the confusion above referred to, is his uncompromising hostility to all the modern hypotheses respecting the nature of light, heat, electricity, etc. He classed all these along with gravitation, and declared that all the efforts expended in the vain search after their origin, nature, or cause, were simply squandered. These agencies, according to him, were merely *phenomena*, and were to be studied only as such. The imaginary interstellar ether was an ontological conception, a metaphysical entity, to be classed along with phlogiston, and all the spirits of the laboratory, and the imaginary occupants of the bodies of men, animals, and inanimate objects. The undulatory theory of light was no better than the emission theory, and both equally vain attempts to know what, from the nature of things, can not be known. In fact, the domain of the Unknowable in Comte's philosophy was enormous in its extent, and, when we contemplate the little that was left for man to do, we almost wonder how he should have regarded it worth the labor of writing so large a work.

The amount of mischief which this one glaring fallacy accomplished for Comte's system of positivism, insinuating itself into every chapter, and more or less vitiating the real truths contained in the work, was so great as to give considerable color to the claim that pure Comtism, if it could be made to prevail and exert its legitimate influence upon human inquiry in the future, would so far cripple every department of science as to throw it back into mediæval stagnation. For it would strike a fatal blow at all true progress in human knowledge by crushing out the very spirit of inquiry, and would quench all interest in phenomena themselves by prohibiting the search after the springs and sources —the *causes*—of phenomena which furnish the true life and soul of scientific research.

Having thus dwelt sufficiently upon the elements of Comte's philosophy, which have tended to render his works both unpopular and unknown, and which in themselves would be sufficient to condemn their unconditional acceptance, let us now return to the primary truths of positivism, and rapidly follow the author through the six volumes of his "Philosophie Positive."

Next after the establishment of an adequate definition of the term *positive*, the most important consideration embraced in the Comtean philosophy, and one which, whether true or not, is certainly new, is the manner in which the human race has reached the condition required for the practical application of the principles of positivism.

That there exists, and, so far as literature gives us any account, has always existed, a fundamental schism in the human mind, perpetually presenting two opposing modes of explanation for the current phenomena of life and the universe, has long been understood, and in recent times a few attempts have been made to subject it to a partial analysis, and to introduce terms designed to bring out into clearer antithesis this deep-seated intellectual antagonism (vol. i, p. 64; ii, 24). This movement has finally resulted in arraying the theological world on one side of an imaginary line and the scientific world on the other, although it is every-where conceded that there are many truly great scientific men who see the universe in much the same way that theologians in general see it, while a few theological minds are not wholly satisfied with the prevailing theological method.

A closer inspection reveals the fact that the difference lies deeper, and, though usually determined by the boundaries named, is not necessarily so determined. The essential question is whether the antecedents of the phenomena of the universe are arbitrary and independent of the phenomena, or whether they are constant and connected necessarily with them. The scientific school and science as a whole are perpetually tending to demonstrate, by an immense and increasing induction, the absolute dependence of all phenomena upon their antecedents, as against the theological view, which makes them rest upon the arbitrary free-will of deity or of man. That the scientific method is gaining ground while the theological is losing, is proved by the concessions of theologians themselves, who nearly or quite all have latterly adopted a species of "dualism," * in which they admit the constancy of natural law within certain limits which vary with almost every individual, and always cease at the point where, according to the complexity of the operation and the analytical power of each mind, no mechanical principle can be further followed out. It is, however, asserted on the one side, and admitted on the other, that this does not necessarily touch the foundations of theology; for, even could all the phenomena of nature be shown to result from unchangeable laws, it is no more difficult to conceive a universe impressed by its creator with all its laws than with a few of them, or none at all. As a philosophical principle, therefore, the theological question is not involved, but as an historical fact, the only point of view from which Comte considers it, it is, of course, of the first importance.

He takes a different and, as I have said, a novel view of this important fact in the intellectual history of the race, the difference consisting in the introduction of an intermediate phase between the theological and the scientific, or, as he calls it, the "positive," and also in the extreme position which he makes this latter phase assume by ignoring all efficient or necessary mechanical causes. This intermediate stage in the

* Haeckel, "Schöpfungsgeschichte," S. 31, 67, 90; "Anthropogenie," S. 12, 64.

progress of the human mind from the theological to the positive state is the metaphysical, in which *entities* are created as connecting links between the antecedents and consequents, and called explanations. This metaphysical or ontological field is so enlarged as to embrace the true scientific materialist who would account for gravitation, electricity, light, heat, etc., by introducing material atoms, fluids, ether, etc.

The theological conception assumes the direct intervention of an intelligent agent presiding over the universe, to whom is attributed the arbitrary disposition of each modification undergone by nature. The metaphysical conception searches for some entity to whose intervention the phenomenon in question is to be ascribed. The positive conception disregards all causes, and addresses itself solely to the study of phenomena as they present themselves to the senses.

These three distinct states of mind, all of which, in point of fact, are admitted to exist together at the present time, and perhaps to have always done so to a greater or less extent, Comte declares to have undergone a regular progressive movement in the history of society. There have been three successive epochs, during which these three philosophic principles have, each in its turn, predominated over both the others and controlled the current of human events. Western Europe (America is scarcely recognized) is the only region of the world in which this progressive march has been completed, and the full ascendency of the last or positive stage reached. Indeed, in all other parts of the world the first, or theological, stage still prevails; the second, or metaphysical, although a necessary condition through which all must pass if they ever complete their progress, being only a brief transition state required to usher in the final era of positive thought. For this and other reasons, Comte, in his "rapid" historical sketch of the history of civilization, confined himself to that of the white race, or at least to the strict line on which the highest civilization of his day has advanced, and deprecated the tendency of certain writers on the origin and progress of civilization to wander off among the many scattered peoples of the globe, whose condition and history sustain no immediate relation to ours, in search of evidences bearing upon the civilization of the "*élite* of humanity."

The theological supremacy was maintained, according to him, down to the close of the thirteenth century, when it was compelled to give way to the metaphysical conception which prevailed in Western Europe for the next five centuries, or down to the beginning of the present. The true ascendant of positive ideas has, therefore, but just commenced. Each of the two preceding stages, however, has had its period of highest glory followed by a period of decline, the latter being overlapped by the power which was destined to supplant it.

The theological period is distinctly marked by three successive stages: fetichism, polytheism, and monotheism. The first, recognizing the existence at all times and places of unseen supernatural forces, constitutes the stage of most intense theological activity and most complete theological supremacy. The second, by originating a priesthood, organizing government, and subjecting the masses to slavery, proved favorable to progress, both intellectual and material. During its reign, not only were the seeds of monotheism, which was destined to overthrow it, sown in Egypt and Syria, but the metaphysical conception took deep root among the Greek philosophers, and even the positive method found a remarkable expression in the works of Aristotle, Archimedes, and Hipparchus. The true theological spirit had declined, and, when at length the Semitic doctrine of the unity of God spread into Greece and Italy and deposed the pagan deities, a new priesthood arose and a complete reorganization was effected. Polytheism had given way to monotheism. The two great branches which broke away from the grand trunk, and formed the Greek Church in Eastern Europe and the Mohammedan religion in Asia and Africa, were both monotheistic, never to revert to polytheism, but intellectually incapable of coping with the highest mental powers of mankind embodied in Catholicism. This last was left to complete the theological stage of human progress, and in turn to yield to the irresistible power of events in the inauguration of the metaphysical stage, or age of independent criticism.

The intellectual reformation of France and Italy was scarcely less thorough than that of Germany and England. The vast and wonderful power of Catholic organization during the middle ages, for which Comte evinces the most extravagant admiration, was broken, never to be re-installed, and a stage of complete intellectual license and anarchy began. During the fourteenth and fifteenth centuries the critical movement was spontaneous, without possessing any systematic doctrine, while during the sixteenth, seventeenth, and eighteenth, the disorganization became complete, and culminated in the establishment of a philosophy which was formally *negative*, and which, for a long time, prevailed over the social, political, and religious interests of the world. The true father of this negative philosophy is declared to be Hobbes, who was seconded in England by Locke and others, and the doctrine was carried to its extreme length in France by the writings of Voltaire, Rousseau, Helvetius, and Diderot. In religion, Protestantism, with its wholly anti-theological and "bastard" principle of the right of inquiry, spread over Northwestern Europe, and so poisoned the atmosphere of France and Italy that the papal supremacy was wholly destroyed. In politics, the reins of government were seized by lawyers and *littérateurs*, and a system was inaugurated which Mr. John Stuart Mill, in his correspondence with M. Comte, aptly styled "*pedantocracy*," * a name which the latter gratefully adopts. In industry, socialistic schemes of the most visionary character were prevalent, rendering the general anarchy complete.

The positive or final stage of progress, whose actual

* "Philosophie Positive," vol. vi, p. 448.

ascendency dates only from the beginning of the nineteenth century, but which primarily took root in polytheistic antiquity, received its grand impetus, and placed itself beyond the power of further repulse, in the age and through the agency of Bacon, Galileo, and Descartes. Lord Bacon laid the foundation of the future system of positive philosophy by the establishment of the canons of observation and experimentation. Galileo, born only three years later, confirmed the reliability of these canons, by making extensive practical application of them to the great problems of astronomy and physics, though without any acquaintance with the works of his illustrious English contemporary. Descartes, laboring more than a quarter of a century later, in the full knowledge of the works of Bacon and Galileo, and in the enjoyment of the ripest scholarship, crystallized the results achieved by all his predecessors and contemporaries into a grand system of genuine philosophy, which, more than any other human production, bore the stamp of the true positive method. Ripened by the genius of these great minds, the harvest of science at once began, and, during the three centuries that followed, a complete revolution was wrought in the world. The idle dialectics of the school-men was superseded by the search for truth; the destructive tendencies of the negative philosophy were counteracted by the constructive tendencies of the positive; and, although as a system of philosophy the scientific method had as yet neither name nor recognition, the commencement of the present century found it master of the whole field, and, by means of its irresistible weapons of knowledge and material prosperity, pursuing its victorious march over the crumbling ruins of theological systems and amid the vanishing shadows of metaphysical eons. It remained only for Comte to trace the path of these mighty events in the history of thought, to assign to each its appropriate limits, and apply to the whole a terminology adapted to so profound a theme. Whatever may have been his errors of detail or his exaggerations of particular parts of his subject, his knowledge of the general trend of society and human thought is certainly wonderful, and his mode of presentation is of the highest originality and the deepest interest.

Next after its definition and its history, by far the most important characteristic of the positive philosophy is the manner in which it classifies the sciences. Instead of regarding the various branches of man's knowledge of nature as so many distinct, independent, and co-ordinate sciences, as much of the philosophy of modern times tends to do, Comte conceived them as not only related and mutually dependent, but also as definitely subordinated to one another, so as to form a regular scale or "*hierarchy*." This classification was, with him, a strictly natural one, and based upon the same essential principles that govern the classification of scientific objects, such as plants or animals. In his treatment of the sciences he proceeds from the more general to the more special. Each new science, as we descend the scale, is less general, and therefore is embraced within the limits of the preceding, to which it stands in the true logical relation of species to genus, while at the same time possessing special characteristics of its own which distinguish it from all above it. But this "hierarchy" differs from most systems of scientific classification adopted for the subordinate sciences by being free from all arbitrary or artificial taint, and based, as M. Comte fully believed, upon the true order of nature as revealed in the history of the evolution of the human mind and of the universe. An absolute derivation of each science from those higher in the scale ("filiation"), and a complete chain of dependence ("solidarity") of the whole, constitute the distinguishing characteristics of the system. The descent was, therefore, by a continuous and unbroken line through the entire range of human knowledge, always passing from the more general, which is also necessarily the more simple, to the more special, which is the more complex.

In order that the merits of this scheme may be better understood, let us first state its exact terms, and enumerate in their natural order the several sciences recognized by Comte. They are six in number, as follows: 1, Mathematics; 2, Astronomy; 3, Physics; 4, Chemistry; 5, Biology; and, 6, Sociology. These are, according to Comte, the six natural divisions or "categories" under which all human knowledge falls, and the above arrangement of them is the order which they must necessarily assume in the scientific hierarchy. Each of these, after the first, is embraced in the definition of the one above it, and at the same time possesses special qualities not possessed by any higher in the scale. Each one, as we descend, is more ample in its scope but less numerous in its details than the one below it. From first to last there is a diminishing generality and an increasing complexity. At the same time there is neither break of continuity nor lack of lineal dependence—there is both "solidarity" and "filiation" throughout.

There is one important law which Comte says had never been perceived before him, and upon which he frequently insists, which is well worth a careful consideration even in this brief sketch, and which it also seems necessary to understand before we can justly appreciate the true nature of the scientific hierarchy. This law concerns the observation of phenomena, and explains the variation in kind which this observation undergoes in its application to sciences occupying different places in the positive scale. In proportion as the phenomena to be investigated become more complicated, they are at the same time susceptible of more and more extensive and varied means of exploration, although this increase of facility is not proportionate to the increase of difficulty. There are thus three general classes or methods of observation applicable to more and more complex phenomena, the first of which is chiefly applied to the higher and simpler, and the last to the lower and more complex sciences.

These three methods are, first, *observation proper*, *i. e.*, the direct examination of the phenomena as they naturally present themselves; secondly, *experimentation*, the contemplation of the phenomena after they have been more or less modified by artificial circumstances; and, thirdly, *comparison*, which is the connected consideration of a succession of analogous cases in which the phenomena grow more and more simple.

The first of these methods is the one exclusively employed in astronomy; the first and second are used in physics, but the second more than the first; in chemistry, the second is almost exclusively employed; while the third is the chief method applicable to all biological and sociological investigations.

The correctness of this exposition will scarcely be questioned, and its utility must be recognized by all who have perceived that it is the clear analysis of all our mental operations which constitutes the chief distinction between the labors of the true man of science and those of the mere empiricist or the vulgar practicalist who accidentally blunders upon the truth, but loses it before it has an opportunity to bear fruit.

There are certain special tests or canons by which the true place of any science in the hierarchy may be determined independently of the general principles of its relative generality or complexity.

It will always be found that the degree of generality will also correspond with the degree of positivity, while the degree of complexity is an index of the extent to which it is still subject to theological and metaphysical influences, for, in proportion as each science is lower in the hierarchical scale, it becomes in that proportion the more subject to the influences of metaphysical and theological conceptions.

This principle, which is clear enough when we come to biology, and especially to sociology, where these conceptions still have full sway, becomes a paradox when applied to astronomy, the grand science which is supposed to constitute in itself a certain cure for skepticism, and to inspire the loftiest ideas of the divine power and majesty. That this law does hold good of astronomy, however, must be admitted when we examine more closely the real merits of the question. The proper test of the supremacy of positive over theological and metaphysical ideas is the degree of faith reposed in the constancy and regularity of the laws of nature; and, while in the laws of society and those governing the animal and vegetable kingdoms, and even to some extent in those of chemistry and physics, there may prevail a belief that the natural and regular laws are superseded by arbitrary fiats of divine power, no educated ecclesiast even of Comte's day would have maintained that aught but absolute and unvarying law and order prevail among the celestial bodies. About the last instance of this kind was that of Newton, who brought in divine agency to account for so much of observation as his theory failed to explain, and this is now set down as one of the unfortunate weak points in his biography, to be forgotten as fast as possible. Those, therefore, who imagine that theology influences their views of astronomy are mistaken; though they may not be aware of it, they are really emancipated from those influences, in so far as that science is concerned. They only lack the power to analyze the inconsistency they are living, and perceive the incompatibility of their theological with their astronomical education. It is, moreover, doubtless true, as Comte says, that the apparent reverence inspired by astronomical phenomena is due rather to *ignorance* than to *knowledge* of them. The phenomena appeal to those who are ignorant of their laws the same as to such as are acquainted with them. The former class still predominates largely, even in the most enlightened countries, and it is from such that the greater part of the religious awe for the mysteries of the universe proceeds. Those who *know* the mechanical regularity of the celestial orbs, while they may admire the positive order of nature, and as they labor glow with a lofty sentiment of love for truth which some confound with religion, but which is a far nobler impulse, are little inclined to see in this order, which they can calculate with precision and predict for centuries, any evidence of a divine interference or supervision. Moreover, it could scarcely be expected that the emancipation of a single science should be sufficient to purify all the rest from teleological tendencies, since there have been so many of the greatest philosophic minds of the world sharing the sentiment of Kant, the founder of the uniformitarian school of astronomers, who did not deem it illogical or absurd to introduce an arbitrary free-will into biology and ethics, of which he knew less, while claiming regularity and invariability in the domain of astronomy, which he thoroughly understood.*

Astronomy was thus regarded by Comte as the only science completely emancipated from theological and metaphysical conceptions, and as being already firmly established in the true positive stage of man's intellectual development.

The principle of scientific prevision or prediction is another of the fundamental tests of the true position in the hierarchy. Indeed, it constitutes the essential quality which distinguishes all that is entitled to the name of science. The entire utility of all science and of all knowledge consists in our ability, by the aid of it, to foretell future phenomena. This ability will be possessed exactly in the degree to which observed phenomena are co-ordinated into laws. This is also the test of the degree of positivity of each science. In point of fact all phenomena are absolutely uniform, and may be co-ordinated into fixed and invariable laws. Our greater ability to accomplish this with respect to some sciences than to others is due to the greater imperfection of our knowledge of the phenomena of the latter than of the former, and not to the increased regularity of certain

* "Kritik der Urtheilskraft," § 79; "Kritik der reinen Vernunft," S. 260, 288; "Allgemeine Naturgeschichte und Theorie des Himmels," S. 294, 313, 314.

phenomena over certain others. Where all the phenomena of a branch of science are positively known, being absolutely invariable, it is of course possible to establish the precise laws of their operation, and, by the aid of these, to predict with certainty all future results. By applying this test, the undeniable logic of Comte's classification is better shown than in any other way.

Astronomy is certainly the science whose future events can be most accurately predicted. The phenomena of eclipses, occultations, transits, etc., are forecast in the computing-room for as many years in advance as may be required, from the observed facts previously recorded; and the navigator, setting out for a voyage of several years, takes with him his almanac containing all the celestial phenomena that can be of service to him for the whole period of his absence. This science must, then, have reached an almost perfect state of positivity.

Applying the same test to physics, we perceive that, while many results can be predicted, they are fewer in number, the predictions are less certain, and the period of time over which they may be extended is not so great as in astronomy. Yet it is upon the certainty of these predictions that all mechanical appliances rest. The greater part of all material civilization is due to the high and constantly increasing degree of positivity attained in the department of physics.

The place of chemistry, viewed by this standard as by the others, is next below physics, of which it is defined as simply the molecular department. It is not only natural that molecular phenomena should be less clearly understood than molar phenomena, but this is in point of fact the case, and many and great difficulties which beset the chemist, in his efforts to decompose and to recompose the different compound substances, all arise from his inability, from observed facts, to predict more or less remote consequences. And when he enters into the department of organic chemistry, which lies over against biology, he finds no end of problems which have thus far, at least, remained irresolvable. But whatever progress has been made—and it must be admitted to have been very considerable—has been due to this same condition of positivity, this quantitative exactness of man's knowledge of observed phenomena, and his consequent ability to foresee future results by the light of invariable laws.

In biology this scientific foresight is still less clear; and, when we remember that it is under this category that all questions of physiology, hygiene, and pathology fall, the immense importance of strengthening this faculty will be at once apparent. Yet here the only success whatever, thus far achieved, in raising the physical standard of man, has come from this same power of predicting future results from past experiences.

Lastly, in sociology, the most complex of all the sciences, which, with Comte, embraces all the phenomena of human action, we find the power of prevision in a very imperfect and undeveloped state. As far as individual action is concerned, this power is wholly abnegated by the majority of mankind, and its place supplied by a general belief in the doctrine of an arbitrary free agency in each individual—a purely theological state. As regards social action, it is for the most part given over also to the theological belief in an external divine agency as arbitrarily determining all the events of society, of history, and of progress. With such beliefs prevailing, there is, of course, no room for any form of prevision or prediction. In politics, however, there has always prevailed an ill-defined notion of the power to modify future events by means of legislation, but so imperfect has been the knowledge upon which this action has been based, and so untrue the conclusions which have been drawn from it, that either all such attempts have miscarried entirely, or else, as has more commonly occurred, results wholly different from, and not unfrequently the direct reverse of, those sought, have been produced. This fact has given encouragement to the negative school, and chiefly contributed to the establishment and support of what is known as the doctrine of *laissez faire*. This doctrine Comte, with his accustomed consistency, repudiates, and insists that the time will yet arrive when all the branches of sociology will be founded on the known and positive laws of its accurately observed and systematically co-ordinated phenomena, by the aid of which all the events of the future can be predicted with certainty, and the true avenues of human progress laid out in advance.

There is no portion of Comte's entire system which is better founded, or more absolutely sound, than this important principle of scientific foresight. "Voir pour prévoir" * is Comte's maxim, and it deserves to find its way, not only into the current philosophy and science of the age, but also into the vocabulary of popular sayings of the people of every tongue.

It would be unjust to M. Comte to pass from this important consideration without noticing the further fact that in elaborating it he has not failed to add, as an essential concomitant of prevision, the necessity of what he calls the *voluntary modification* of phenomena. In most sciences this is the main *desideratum*, which, though impossible without the power of prediction, becomes, in the light of that faculty, the chief dynamical quality of man's supremacy over nature. My own appreciation of both branches of this argument will be found in other parts of this work (vol. i, p. 54; vol. ii, p. 376).

Let us now follow the author a little way into the examination of each of his six fundamental categories of science. The greater part of the first volume of the "Philosophie Positive" is devoted to a rapid, general survey of the science of mathematics, a treatise respecting the intrinsic ability of which we are not here directly concerned. This much may, however, be said by any reader, even though he may acknowledge his lack of the necessary qualifications to pass judgment upon a purely mathematical treatise, that not only

* "Philosophie Positive," vol. vi, p. 618.

here, but in treating of all the other sciences, M. Comte has applied a principle the almost total disregard of which in all text-books has done, and is continually doing, more to secure for them the reputation of being dry and repugnant than all the rest of their too obvious defects. The essence of this principle is contained in this pregnant remark, made almost at the outset of his great work: "We are certainly convinced that the knowledge of the *history* of the sciences is of the highest importance. I even think that no one completely knows a science so long as he does not know its history." Surely there is no science to which this canon needs more to be applied than to mathematics. In consequence, therefore, of this historical method, no one can read Comte's treatise on mathematics without great interest.

Mathematics is regarded by Comte, not as a separate science, holding the highest rank in the positive hierarchy, but as the true basis of all the sciences, and of the positive philosophy itself. He lays great weight upon the important principle laid down by Descartes that all questions of quality are reducible to those of quantity, and that, therefore, the theoretical perfection of every science, even the complex ones, such as biology and sociology, is the reduction of all its laws to mathematical precision. Every truth in nature is not only capable of being stated in one simple proposition, but it is also capable of expression by means of an equation. The position of any given science in the scale of theoretical perfection may be judged by the completeness with which it is capable of fulfilling this condition, and this becomes, at the same time, the criterion by which its true relative place in the hierarchy is determined. Every true science, in the positive sense of the term, embraces some general class of phenomena, and has reference entirely to the operations of nature, objectively and concretely considered. The totality of all the sciences embraces the knowledge of the active, changing, and real universe. In proportion as these different classes of phenomena become more complex and obscure, the less capable will beings of a given degree of intelligence be of reducing their laws to mathematical rules, the more will they be compelled to confine their understanding of them to approximate, qualitative laws, and forego the benefits of exact, quantitative knowledge. Having arranged all the sciences in a true ideal hierarchy based on this distinction, we may, in theory, imagine them to become successively more and more perfectly known, and one by one to reach this highest and most perfect positive or quantitative stage. But, after the last one has reached it, and all the phenomena of the universe have become subjected to absolute mathematical formulas and equations, it is clear that the so-called science of mathematics will have no distinct and independent place of its own in the hierarchy. Each of the true sciences will employ its principles in explaining the objective truths of the substantial universe, but mathematics, possessing in itself no such substantial truths, and no objective phenomena, will have been wholly absorbed, and occupy no separate rank or position in the scientific hierarchy. The so-called pure or abstract mathematics has no real existence in itself. To claim this for it is to remand it to the age of metaphysical entities. It is simply the ultimate principle of the relations which concrete things sustain to one another. Mathematics is, therefore, the condition of science, rather than a science in itself, the instrument with which the mind works for the perfection of our knowledge of ultimate truth.

Notwithstanding this well-marked distinction of *abstract* from *concrete*, as most adequately expressing the relation of mathematics to science properly so called, Comte sees fit to employ these terms in the subdivision of mathematics itself. In doing so, however, he uses the term *concrete* in a somewhat different sense from that in which it has been here employed, and from its ordinary acceptation. With him abstract mathematics is simply the operation of solving problems already stated, "*le calcul,*" the calculus, or process of calculation or solution. Concrete mathematics, on the contrary, is its application to the solution of problems, whether actually existing in nature or ideally conceived in the mind.

The "calcul," or calculus, that branch of mathematics which is alone concerned with the working of solutions for problems supposed to have been previously stated, he divides into two general classes, (1) algebra, and (2) transcendental analysis or calculus proper. The first is also called the calculus of direct functions, and the second the calculus of indirect functions. The former is, of course, the basis of all purely mechanical operations looking to the solution of mathematical problems, and is treated in a brief but broadly general way, which might tend to enlarge the views of even a professional mathematician. The latter embraces the great field of the differential and integral calculus, of the calculus of variations and of finite differences, in the effort to attain to which the highest flights of the human intellect have been taken. Comte's historical and analytical presentation of this part of his subject will probably be set down among the most able and telling efforts of his life. It is scarcely saying too much to assert that a good translation of the seventh, eighth, and ninth lectures of the "Philosophie Positive," inserted as an introduction, or even as an appendix, to any modern text-book on the calculus, would go far to exonerate this useful branch of mathematics from the charge of abstruseness and of "mental gymnastic" which is now so frequently made. The student wants, above all, to know when, where, how, and by whom. He needs to be told the entire *rationale* and genesis of this (to him) so singular a branch of human knowledge; how, prior to its introduction, the sages of the world, with a full knowledge of all that had been done by those who had labored in the same field before them, were exerting every faculty to discover the means of solving the great problems which observational science was thrusting upon them; how, notwithstanding the vast advantage which mathematics had seemed to possess from the days of Archimedes and Euclid, the invention of the telescope and other great facts had opened up new and undreamed-of realms for its application to concrete phenomena, until at last the machinery of calculation was strained to its utmost, and still found inadequate to keep pace with inductive discovery; and how not only Newton and Leibnitz, but hundreds of others, were working, under the resistless spur of certain immortality and apotheosis in case of success, to find the golden key that should unlock these gates of the universe, and that it was under this enormous pressure and in the strife for such inestimable prizes that two men simultaneously and independently achieved the fame they strove for by making these grand discoveries and founding the new science which, without these explanations, appears so abstruse and unpractical. With these facts before them, the blank astonishment so generally manifested by students at the fact of the simultaneous and independent elaboration of substantially the same profound truth, a state of mind which most text-books only seek to intensify, would cease, and the natural deduction of these consequences from the ripened condition of the world would lead them rather to marvel that no more than two intellects should have proved themselves equal to the emergency. At the same time it would greatly strengthen their faith in the operation of law in the domain of mind, and confirm the conviction that, even in the history of the evolution of the human intellect, no phenomenon ever takes place without its necessary antecedents and its sufficient cause.

The rival claims of Newton, Leibnitz, and Lagrange to the honors of this great discovery are ably considered by M. Comte. Dismissing all fruitless discussion of the empty question of priority of discovery by the first two, he addresses himself to a philosophical analysis of the methods by which they, as well as also a little later Lagrange, arrived at and elaborated the principle of transcendental analysis. He perceives that these three men all approached the subject from different directions and considered it from different points of view, whereby an immensely more enlarged conception of it has been gained than would have been possible had the discovery been confined to a single mind, or had there been a concert of action. Although the temptation to enter into details must be resisted in a general sketch of this kind, I can not refrain from strongly commending this portion of the "Philosophie Positive" to all who are interested in tracing the grand triumphs of the human mind and the progress of the investigation of natural truth.

"Concrete mathematics," in Comte's view, may be reduced to two general branches—*geometry* and *mechanics.* Every problem that can possibly present itself for statement may, according to him, be classified under one or the other of these heads. These two terms may be regarded as synonymous with *statics* and *dynamics*, although this is the ordinary subdivision of the latter branch of mathematics only. But a glance at the fundamental principles of Comte's classification is sufficient to show its profound philosophy and general accuracy.

The problems of geometry are clearly all of a statical character, and constitute the science of extension, or space-relations. Those of mechanics, on the other hand, all arise from the actions of forces, a fact which is not altered because those forces are frequently considered as equal and opposite, that is, in a state of equilibrium. Mechanics may, therefore, be regarded as the science of change, or motion, since all forces produce actual or potential change or motion; and, inasmuch as all motion requires time, it may be further defined as the science of time-relations, just as geometry is the science of space-relations. And here we may now see what M. Comte has not failed, though under another head,* to point out, viz., the great philosophic value of this conception as applied to true concrete science even of the most complex character,

* "Philosophie Positive," vol. vi, p. 612.

where the ideas of co-existence and sequence become the two fundamental categories to which all phenomena are assigned. Some of the readers of Herbert Spencer, who brings this conception forward so prominently in his philosophy, may imagine that these categories were original with him, and may therefore be interested to know that they had been previously recognized by Comte.

The hybrid character of the term *concrete* as applied by Comte to statical and dynamical mathematics would now be clear if no further explanation were added. All problems must arise from phenomena, real or imaginary. But nothing can be imagined the elements of which at least have not been perceived. Concrete mathematics is the poetry of science. Drawing its elements from the real fields of observation and experience, it applies the calculus to imaginary spaces and imaginary forces, in which great field of fiction, like romance and epic, it enjoys the immense advantage of utter freedom from the incumbrances of unyielding facts, and has been able to build up a vast ideal fabric for the crude sciences of phenomena to take possession of as fast as they become sufficiently purified to enter the list of quantitative or positive sciences. This field of imaginary phenomena is Comte's conception of concrete mathematics.

Astronomy is regarded by Comte as occupying the first place in the scientific hierarchy, because on applying the test of true positivity it is found to present not only the simplest but also the most general class of phenomena. Notwithstanding the many complicated problems presented by it respecting the influences of the different heavenly bodies upon one another, it is clear that these difficulties are far less than those presented by any of the other sciences; and although some of them, as for example the problem of three bodies, are, in the present state of the calculus, beyond solution, still the number of such questions is comparatively small, and they frequently depend upon the imperfect state of abstract mathematics rather than upon that of direct observation—

i. e., upon ignorance of methods of solution rather than upon ignorance of observed facts.

This condition of simplicity and generality, which is characteristic of astronomical phenomena, leads to a simple definition of the nature and object of the science. Astronomy is accordingly defined as "the science which has for its object the discovery of the laws that are presented to us by the geometrical and the mechanical phenomena of the celestial bodies." He discountenances all attempts on the part of astronomers to go beyond this purely mathematical limitation of the science, ignores all the concrete discoveries as to the geography of the moon and of Mars, and all the efforts yet made to ascertain the constitution of the sun and planets. He goes further, and declares the utter impossibility of ever learning anything of the chemical composition of the heavenly bodies. The foundations for the actual discovery of what he thus dogmatically declares to be for ever out of the reach of human effort had already been laid by Wollaston and Fraunhofer a quarter of a century before this declaration was made, and a quarter of a century later, as already remarked, the true chemical constitution of the sun and many fixed stars had been, to a great degree, determined.

It seems scarcely necessary to add, from what the reader already knows of his practical severity in repressing all speculations not based upon observed phenomena, that Comte allows little weight to be placed upon the doctrine previously alluded to, as founded by Kant and expounded by Laplace, of the genetic evolution of the solar system from some primordial diffused state of the cosmical matter composing it. He regards this theory, which he calls the "cosmogony of Laplace," as purely conjectural, but finally condescends to give a somewhat extended review of it, and, as to everything else that he treats of, he contributes to it important additions of his own.

His treatment of sidereal astronomy is very brief, since he does not consider the fixed stars as coming fairly within his definition of astronomy, because the geometrical and mechanical laws of their phenomena are mostly beyond the power of human observation. He, therefore, distinguishes sharply between the solar system (*le monde*) and the universe (*l'univers*), embracing all the celestial bodies, and deprecates all premature flights of fancy in attempting to speculate upon phenomena which can probably never be understood with the requisite degree of positivity to be justly classed in the great hierarchy of the sciences.

The second scientific category is physics, which according to Comte consists in the "study of the laws which govern the general properties of bodies ordinarily regarded *en masse*, and constantly placed under circumstances susceptible of maintaining intact the composition of their molecules, and even most frequently their state of aggregation." We perceive by this definition that the chief distinction between physics and chemistry is that the former deals with *molar*, the latter with *molecular* forces; Comte has, therefore, proposed, as another name for chemistry, that of *molecular physics*. As in astronomy the first method of investigation, viz., observation proper of the phenomena in their natural state, was the one necessary to be chiefly employed, so in physics the second method, or that of experimentation, is the one which is demanded by the nature of the phenomena. For here not only has the investigator the power, from his proximity to the phenomena, to alter the circumstances to suit the particular case, but from the variety of the phenomena and his ability to examine them from all sides he is able to make selections from among them, and to institute comparisons between such only as he deems applicable to his particular line of investigation.

Physics, too, comes next after astronomy in the degree of thoroughness with which it has been purged of theological and metaphysical conceptions, and the extent to which true positive principles have been made to preside over its phenomena. Indeed, theological notions may be said to have disappeared from this science almost as completely as from that of astronomy, but its true position, next in the scale below astronomy, is shown by the presence of a large and troublesome class of metaphysical conceptions lingering about it and vitiating the results of human labor in this field. These consist of numerous imaginary entities still brought in to explain physical phenomena, and which go by the names of fluids, ether, and atoms. The uncompromising bitterness with which Comte attacks and denounces these ontological conceptions, as then commonly employed to explain the phenomena of heat, light, electricity, and gravitation, can only be realized by a perusal of this part of his work. The atomic theory, then but just revived by scientific men from the philosophy of Leucippus, Democritus, and Epicurus, is assailed as a vain and profitless hypothesis, seeking to explain the *mode of production* of phenomena. The doctrine of an interstellar medium, or ether, is equally proscribed, as being a line of research absolutely and for ever forbidden by the nature of things. The undulatory theory of light and heat of course suffers the same fate as that of the entity upon which it is founded, and is classed on the same footing of respectability with the Newtonian doctrine of emission, then generally being abandoned. Gravitation, which is perhaps identical with magnetism, and electricity, which is apparently a form of the same force, all are, according to Comte, and must ever remain, absolutely inexplicable, being primordial phenomena or processes of nature. Especially severe is he in his condemnation of the theories of electrical fluids, then generally in vogue. All these processes are to man simply phenomena. They admit of no explanation, being the primary qualities of the original constitution of nature, and all time expended in vain efforts to determine their antecedents and mode of production is declared futile and for ever lost. All of which simply goes to show the power of a system, especially in the mind of a Frenchman, to override and bear down all recalcitrant bits of evidence which threaten to weaken or modify it.

The science of physics is treated under the different heads of barology, thermology, acoustics, optics, and electrology, each of which is presented both historically and dogmatically, and, notwithstanding grave inconsistencies in the above order as viewed with modern ideas, the discussion is made both interesting and instructive to all intelligent readers.

Barology, or the science which embraces all the phenomena of terrestrial gravitation, is regarded as the purest of all the branches of physics, and therefore stands at the head of the category after astronomy.

Next to barology, strange as it may seem, he regards thermology, or the science of the phenomena of heat, as possessing the highest degree of positivity. This opinion was occasioned solely by the great influence which the important treatise of his friend and patron, Fourier, on this subject exerted on his mind, and which he never allows an opportunity to escape of commending in the most extravagant terms, as a perfect model of genuine positive investigation. In this treatise the phenomena of heat are studied simply as such, co-ordinated into pure empirical laws, and subjected to strict mathematical formulas and equations.

The position to which he assigns acoustics, between thermology and optics—the science of the phenomena of atmospheric vibrations between two closely allied branches of the science of the phenomena of ethereal vibrations—viewed from the present stand-point of these sciences, seems irrational enough; but to Comte, who repudiated ethereal vibrations and ether itself, it was quite logical. All he looked for was to determine which was most completely emancipated from theological and metaphysical influences. Fourier had elevated thermology to a place only inferior in this respect to that of gravitation itself. The science of light was still weighed down by vicious undulatory and emission theories.

Acoustics, from the more tangible nature of the atmosphere, then an admitted phenomenon of itself, had made the greatest progress, and already occupied a high plane of positivity. In this discussion he adduces very little that is new, but, notwithstanding his hostility to all theories tending to establish a medium for the phenomena of heat and light, he incidentally offers one of the most convincing arguments for the undulatory theory that can even now be urged in its support. Referring to certain investigations made by Laplace, in consequence of the results of which that great mathematician urged the necessity of combining thermological considerations with the purely dynamic theory of vibratory motions, he points out the significant fact that, in the rigidly positive discussion of that science by Fourier for which he expresses such unbounded admiration, the principal equations offer so great an analogy with those of the vibratory movements of the air in producing sound as sometimes to differ from them by the sign of one co-efficient only! How strange that a love of system should be able to divert so great a mind from the proper appreciation of such a manifest index of nature!

After acoustics, optics is the branch of physics which has attained the highest state of positivity, and aside from its historical presentation, Comte's treatment of it is remarkable only for the unsparing manner in which he seeks to drive out all the ontological beings which he imagined to infest it. He may, however, be admitted to have done good service in pointing out the essentially twofold character of the science, the one physical, the other physiological, and the necessity of preserving these distinct, the former belonging here, while the latter properly comes under biology, and thus falls two grades lower in the hierarchy, so that it can not be intelligently studied until that grade is reached.

Finally, electrology, whose identity with magnetism is admitted, while its relation to gravitation (barology) is ignored, is placed at the foot of the list of physical sciences, as being least understood in its phenomena, and most heavily burdened with vain ontological hypotheses of fluids, atoms, etc. His historical review of the progress made down to his time is, however, interesting reading.

As regards the different branches of physics, Comte evidently regarded them as, to a great degree, independent and their natural order as quite arbitrary, and he distinctly states that it is rather an *ensemble* of various sciences almost isolated, than one truly uniform science—an opinion which grew out of his persistent rejection of every unifying principle, and his willful ignoring of all causal forces, which precluded his catching the faintest glimpse of the law of the correlation and conservation, *i. e.*, the unity, of force.

One degree lower in point of generality and positivity, and higher in point of complexity, stands the science of chemistry, which is defined as having for its object "the study of the laws of the phenomena of composition and decomposition which result from the molecular and specific action of the various natural or artificial substances upon one another." All the tests above described combine in assigning this place to this science. No one will question the superior complexity and obscurity of chemical over physical phenomena taken as a whole. The method of pure experimentation becomes here less universally applicable, and that of comparison has to be frequently called to its aid. The ability to predict results is much less, and the degree of quantitative knowledge of its phenomena and laws is unquestionably lower. He further asserts that the doctrine of chemical affinities is even more purely metaphysical and ontological than that of the alleged fluids and media which are introduced to account for physical phenomena.

The division of the science into inorganic and organic is pronounced irrational, inasmuch as the two are only distinguished by the different degrees of complexity of the substances usually assigned to each, and, as this varies through all degrees, there is no fixed line of demarkation. Still, much that has heretofore been classed under the head of organic chemistry should be assigned to physiology, such as an examination of the composition of sap, blood, etc., and the analysis of the products of respiration, secretion, etc.

Comte's acceptance of the Berzelian principle of "dualism" should perhaps be mentioned, since upon it he founds some claims to an original discovery which he believed to constitute an important contribution to the science. It consists primarily in assuming that, as a result of the different electrical states of different substances, all compounds above the binary ones are composed of constituents which are themselves compounds rather than of the several independent elements separately. The object of this hypothesis is to simplify the analysis of compound substances by first resolving them into groups and then treating these groups separately. This principle had already been extensively applied to inorganic compounds, and he believed that it would prove still more serviceable when applied to the more complex ones derived from organic sources. However far this suggestion has influenced the chemists since Comte's time, it is at least certain that something approaching it is now extensively recognized (*infra*, p. 236).

The science of biology stands very low down in the hierarchy. Founded by Bichat in the very beginning of this century, and first named by De Blainville, the illustrious contemporary and co-laborer of Comte in *l'École polytechnique*, the treatise of the latter possesses an especial interest as constituting the first attempt to generalize its principles. He found it almost wholly given over to the domination of theological influences, the only attempts thus far made to emancipate any part of it having been those of Jean Lamarck and of Étienne Geoffroy Saint-Hilaire. In anatomy alone, some degree of positivity had been reached, and an immense mass of mostly barren facts and materials of natural history had already been accumulated.

The chief object of the study of biology is declared to be the relations of *organization* and *life*, which are said to be mutually dependent—all idea of the subordination of the one to the other being excluded. The important consideration in the discussion of this subject is the mutual influence of the organism and its medium ("*milieu*"). There is no distinction whatever between the notion conveyed by this term *milieu* and that of "environment" employed by Herbert Spencer. The latter may be regarded as a simple translation of the former. If any have supposed, therefore, that the doctrine of the reciprocal influence of organism and environment so ably developed in Herbert Spencer's "Biology" was first proposed by him, they have been mistaken. It is not even original with Comte, as it is introduced and discussed at length by Lamarck in his "Philosophie Zoölogique." *

Between the organism and its medium there is a necessary harmony and correspondence, which constitute the fundamental condition of life. Both tend toward modification, the rise and decline of life being as frequently determined by necessary and spontaneous modifications in the organism as by the influence of surrounding circumstances.

The word *milieu*, so constantly employed by Comte, is expressly defined as designating not only the fluid in which the organism is plunged, but the entire *ensemble* of the external circumstances, of whatever nature, necessary to its existence. Although he alludes several times to the great treatise of Lamarck above mentioned, he seems to have been only imperfectly acquainted with it, since he imagines the term to be new in this sense, and even proceeds to offer an apology for the neologism. Upon a careful comparison I am unable to perceive any distinction between the application he makes of the term and that made by Lamarck, while, as already stated, Herbert Spencer's "environment" can only be regarded as a simple translation of this word into expressive English. Of this Mr. Spencer was doubtless

* Vol. i, p. 145; vol. ii, p. 5.

aware, as he seems to have been somewhat familiar with M. Comte's works, but, if not, it would only prove that in this case, as occurs in so many others, when the knowledge and insight of mankind are rapidly advancing, an important truth had become apparent to three great minds investigating the laws of life, and found expression with each in the most fitting term his language afforded.

An important extension of this principle, for which Comte deserves credit, consists in his application of it to the several organs of an organism, as well as to the whole organism. The correlation is, therefore, in this case between the organ and its medium, which leads to a clearer understanding of the relation between the organ and its function. To determine this relation is one of the most important problems in biology, and affords a reliable measure of its true scientific condition when submitted to the test of the ability to predict. Given the organ or any organic modification, the question is to find the function or mode of action, and *vice versa.*

Notwithstanding the general breadth and liberality of Comte's views of the vital processes, he was not, as a mathematician, sufficiently conversant with the phenomena of biology to appreciate the advanced speculations of Lamarck and Geoffroy Saint-Hilaire respecting what may be called the dynamic phase of this same law of the correlation of organism and environment. It was probably owing to a certain timidity, as not being himself a master in any department of biological science, and these views having the weight of the then greatest authorities against them, that he thought best to discountenance them, and plant himself safely down upon the doctrine of *discontinuity* in the biological series and the fixity of existing forms. That logic would have impelled him to adopt the contrary course can scarcely be doubted when we carefully consider the following remarkable passage: "If we conceive all possible organisms to be successively placed, during a suitable time, in all imaginable mediums, the greater part of these organisms would of necessity finally disappear and leave only those surviving which could satisfy the general laws of this fundamental equilibrium; it is probable, after a succession of analogous eliminations, that the biological harmony must have established itself little by little upon our planet, where we still see it continually modifying itself in a similar manner." *

With regard to the general classification of biological science, M. de Blainville had already proposed the term *zoötomy*, as limiting the study of the parts of living objects to animals alone, thus leaving the word *anatomy* to apply equally well to animals and plants. He had also proposed the term *zoötaxy* to denote the classification of animal forms. Corresponding to this last as a generic term Comte suggests that of *biotaxy*, which seems quite appropriate and needful. He also employs the term *bionomy* as embracing the general science of the laws of living functions, or dynamic biology. This differs very little from pure physiology as applied to both animals and plants. His *biotomy* is both bad in its etymology and wholly needless, being neither more nor less than anatomy, animal and vegetable. By adding three more terms, viz., phytonomy, phytotomy, and phytotaxy, the last but one of which is not very euphonious, a terminology would exist as complete and symmetrical as the science of biology would be likely ever to require.

With Lamarck, Comte inclined to accept the lineal series of living forms, and in one place † declares that this extends from the lowest vegetable forms up to the apes and to man. At the same time he also asserts that there exists no established hierarchy in this series, and, for the present at least, the position of the intermediate terms must be, to a great extent, arbitrary. Yet, holding to the fixity of species, he is not concerned with any theory of descent or genealogical filiation, much less with the idea of a genealogical tree,

* "Philosophie Positive," vol. iii, p. 392.

† *Ibid.*, vol. iv, p. 443.

although he intimates that the doctrine of an order of two or three dimensions analogous to that of geographical charts, as a substitute for the lineal series, though an unrealizable hypothesis, is an evident symptom of a growing but as yet confused sentiment of the true natural method.

The entire science of biology, according to Comte, may be arranged into three natural divisions—not, indeed, wholly independent and distinct, yet sufficiently so in their general character to constitute a convenient classification in substantial harmony with the hierarchy of the sciences.

The first of these divisions concerns the laws of what is understood as *vegetative* life; the second, those of *animal* life, properly so called; and the third, those of the intellectual and moral capacities of living beings. It is of course unnecessary to say that the distinction of vegetative and animal life is not at all the same with that of plants and animals, botany and zoölogy. Vegetative functions belong equally to animals, even the highest, as man. Indeed, this subject, discussed by Aristotle, Buffon, Bichat, and all modern biologists and physiologists, is too familiar to require further notice here, as M. Comte adds little to its already established character and scope, and has been greatly distanced by more recent investigators. We will pause a moment, therefore, upon the last of his divisions, and consider what he has so appropriately styled "transcendental biology."

The absence of *psychology* from the list of Comtean categories and from the scientific hierarchy has, no doubt, already been noticed with surprise. This surprise may not be lessened when the reader learns that this science is there made a branch of biology. It will certainly be immensely heightened on finding it based solely on *phrenology*. Yet such is the case. There is no part of the "positive philosophy" which has been more severely criticised than this remarkable new departure, in making phrenology, as expounded by its founder, Dr. Gall, the basis of all the phenomena and laws of the mind. Nevertheless, it should be remembered that phrenology in Comte's time had not yet so totally disgraced itself by systematic jugglery and itinerant charlatanism as it succeeded in doing during the decade which followed his death, and yet it had gone so far even then that he was obliged carefully to define his understanding of the term, and to denounce its tendency to quit the high plane of true science upon which Gall had erected it. It is not a little surprising, therefore, to see critics of the acknowledged candor of John Stuart Mill * alluding to Comte's indorsement of phrenology without doing him the justice of making this explanation. For, notwithstanding the admirable etymology of this word as the name of a great science as yet scarcely founded, Comte rejects its unqualified use in consequence of the bad company into which it had already fallen, and prefers to substitute for it the qualified form, "phrenological physiology." He has not accepted all the views of Gall, and notably the important one respecting the localization of the faculties, which was the real bane of the entire system, and accomplished its overthrow. This he declares to be "evidently venturesome and notoriously erroneous," and the "fundamental vice" of the system. The utmost that he is willing to allow in this direction is the division of the faculties of the mind into two general classes, the "affective" and the "intellectual" faculties, the former of which belong to the whole posterior and middle portion of the cerebral apparatus, while the latter are confined to the anterior portion; and the further subdivision of each of these, the "affective" faculties into inclinations and sentiments, the former of which reside in the posterior and lower part, and the latter in the middle part of the posterior region of the brain, and the "intellectual" faculties into perceptive and reflective, the latter occupying the antero-superior frontal region as their true seat, and constituting the highest cerebral functions. Much of this the progress of science has substantiated, while it is also actually building up a new phrenology and estab-

* "Auguste Comte and Positivism," p. 65.

lishing a system of distinct localizations, which, though not those of the old school, are equally arbitrary and far more remarkable.

What Comte aims to demonstrate is simply the physiological basis of psychic phenomena, and, as the brain is the seat of the greater part or all of these phenomena, the term phrenology is not in itself objectionable. That the actions of the mind are as much the visible outcome of physiological processes in the appropriate organs as are the actions of the limbs, Comte did not for a moment doubt, and thus he was perfectly justified in the assumption that mental phenomena can be studied like other phenomena, their laws established, and the science of the mind founded on strict scientific methods of observation. The mere observation of the secondary results of these phenomena, that is, of the so-called mental states of individuals, did not seem to him sufficient. These mental states are the results of real physiological processes taking place in the tissues of the brain and nervous system, and it is these that should be studied. For the current psychology of the schools, he, of course, entertained the most haughty disdain. The method of "interior observation" he condemned in the most unmeasured terms, and declared it to be an impossibility and a delusion based on an attempt to reason in a circle. The minds of animals differ only in degree from those of men: ideology, as Tracy had remarked, is a part of zoölogy; De Blainville's *dictum* that "instinct is fixed reason—reason is movable instinct," is indorsed. Morality, in so far as it concerns the individual, is founded on sympathy, and becomes the basis of his famous doctrine of *egoism*, for which he invented the exceedingly appropriate and much-needed correlative, *altruism*, the basis of all objective morality.

In most of his views on the physiological nature of mental phenomena he had been anticipated, and in many far transcended, by his illustrious countryman Lamarck, whose remarkable chapters upon this subject, with a little reasonable allowance for the age in which he wrote, form quite interesting reading even in our own times.

Whatever may be said of Comte's qualified adoption of the term *phrenology*, his unqualified rejection of the term *psychology* is at least justifiable in view of the whole tenor of his philosophy. The former not only possesses the merit of an unexceptionable etymology, but, what is more important, it expresses in itself the complete notion of the physiological basis of all psychical phenomena. Cutting loose from the vague and ethereal conceptions to which the terms soul, mind, spirit, etc., give rise, as possessing nothing sufficiently tangible and positive for science to lay hold of, it brings immediately forward the visible object and tangible substance of the physical brain as the true source and fountain of the most complex and wonderful manifestations in the whole domain of nature. Psychology, on the other hand, besides being identified in its composition with all that is vague and unreal in human thought, is scarcely as yet emancipated from the fogs of mysticism, scholasticism, and metaphysical speculation. It is difficult to say which is more to be regretted, the loss to science of so admirable a word as "phrenology," through the unfortunate associations into which its too hasty introduction condemned it, or the probable revival, as the name of a positive science, of so objectionable a word as "psychology."

Lowest in the scale of positivity, most thoroughly given over to the control of theology and metaphysics, presenting phenomena most difficult to foresee, and capable of being studied only by the method of comparison, yet constituting the most practical and important of all the sciences, stands *sociology*, the science of the collective action of mankind.

The eminent founder of this great science, in the *chef d'œuvre* which we are considering, has assigned to it a place and space commensurate with its importance. Three of the six volumes of the "Philosophie Positive" are devoted to this science alone, and it is in these three volumes that he has taken the occasion to deliver to the world the most important of his views on all the questions which the history of man has presented to the philosophic mind. The general outline of this discussion has already been stated, and needs here only to be recalled in the special order adopted by M. Comte.

Agreeably to his fundamental principle respecting the method of presentation of all the sciences, that it be both *dogmatic* and *historical*, he has so presented this science of sociology, or, as he still modestly calls it, "Social Physics." * He begins with the "dogmatic method," and considers all the phenomena from the two general points of view of the *order* and *progress* of society.

On this distinction of order and progress, Comte's ideas are not only exceedingly luminous and interesting, but also pre-eminently sound and philosophical. With the eye of a true philosopher and co-ordinator of truth, he here clearly perceives and points out the direct derivation of these two sociological factors from the two corresponding biological ones, to which he had paid such special attention, viz., those of *organization* and *life*. He sees that this is no mere accidental analogy, but one and the same principle manifesting itself in identical relations under slightly changed names in the two intimately related sciences. Order is organization, the systematic adjustment of parts to a whole. The universe, in its sublime order, is simply a vast organization, held together by laws that bind its parts together. A living organism is nothing more; the social order is nothing less. Life, on the other hand, is growth; when growth, both in quantity and quality, ceases, death begins. With an entire organism this may appear obscure; with the ultimate elements of organization it is clear. So clearly did Comte see this principle that, although he resisted the newly proposed cell-theory of the tissues, he yet made bold to assert that the

* The term "sociologie" first appears on page 185 of vol. iv, but, in the headings of the chapter and head-lines of the pages, it is called "physique sociale."

decline of life of every organism is a gradual death. But, if life means simply growth, growth is clearly nothing else than progress in organization, either in extent, variety, or refinement. This fundamental fact of biological science crops out into full view as one of the prime factors of social physics. As in the organism, without organization there can be no life, so in society, without order there can be no progress The two are indissolubly connected. Just as surely as the destruction of its organization destroys the life of a plant or an animal, so surely will the overthrow of order in the human race be the extinction of its progress. This comparison constitutes one of the best illustrations of the value of a full comprehension of the dependence of the more complex and special sciences upon the more simple and general. By the ordinary intelligence, viewing, as it does, the complex phenomena of society because they more directly appeal to it, but ignorant of biology because deemed of no practical importance, this fundamental truth is wholly ignored, and in its place is generally found the highly pernicious error, the precise opposite of the truth, that order and progress are directly antagonistic. Although incapable of clearly comprehending the philosophical discussion relative to the relations of order and progress in society, the average man, even in the less civilized countries, practically acts upon just this question, but in so crude and imperfect a manner as wholly to mistake the relation of the terms while definitely understanding the terms themselves. For to what does the great problem of human advancement amount but to this same question of order and progress? What retards human advancement? Undue respect for the established order. In every age and nation of the world there have always been a party of progress and a party of order. Let no one be misled by the names that have been applied to these two parties. All stronger terms than these have been invented by one party in the heat of passion to stigmatize its opponent. The party of progress calls the party of order conservative, retrogressive, *Bourbon*.

The party of order calls the party of progress radical, revolutionary, *Jacobin*. And, although Comte is not wholly free from the use of hyperbole of this nature, he nevertheless gives mankind the credit for generally meaning well. The difference simply is that, while one class possess a high regard for the benefits of the established order and view with dread and horror all attempts to disturb it, the other class, perceiving its defects and thinking they see means by which it can be improved, are anxious, not generally to overthrow all order, but to sacrifice existing order for the sake of establishing a higher and a better order.

Yet, without a clear conception of the true relation of order to progress, both parties usually go to extremes. The party of order, in their love of order, come to hate progress, and regard it as the enemy of order. The party of progress, in their zeal for progress, come to detest order, and to regard it as the great obstacle to progress. Illustrations of both these phases, were they not abundant in every one's range of observation, might be found on a large scale in the civilization of China on the one hand, and in the French revolutionary element on the other. In the former, nearly all signs of progress have been crushed out by the overweening reverence for order. In the latter, all thought of order was banished, and progress was vainly sought through the mere negative process of destroying the established order. In fact, the history of the world is the history of this alternate rhythmical struggle between the elements of order and progress, recording the protracted persistence of the former, followed at length by their complete surrender to the unbridled power of the latter, which, carried to great excesses on the waves of victory, are in turn overtaken and engulfed in another long wave of reaction, and so onward through all time. How changed would all this become could mankind be brought to realize that the true *object* of order is progress, while the true *condition* of progress is order!

The positive principle which underlies all considerations of order and progress is the mathematical distinction of statics and dynamics, which, as we have seen, formed the primary subdivision of what Comte denominated "concrete mathematics"—geometry and mechanics. This only serves to illustrate the fundamental and comprehensive character of his generalizations. Whenever biology and sociology shall have passed through their imperfect stages of theological and metaphysical supremacy and emerged into the pure light of positive science, then will *organization* in the one case and *order* in the other be capable of and receive their true quantitative laws under the domain of statical mathematics, while the *life* of the organism and the *progress* of society will become subject to the exact canons of rational mechanics. Such is the future of these great sciences, which in his time were in the act of being born, and which are still in the swaddling-clothes of infancy! In the present state of sociology all mathematical notation is of course wholly inapplicable. Nevertheless, it can not be denied that the primary classification of the laws of this science into statical and dynamical, while it avoids all vain pretensions to mathematical exactness, preserves better than any other the notion of its true positive character, and gives to the fundamental distinction of order and progress a scientific synonymy of great propriety and value. It will be further observed that this distinction is none other than that already alluded to of coexistence and sequence.

We have, therefore, the primary division of the laws of social physics into the two great sub-sciences, social statics and social dynamics, the former of which studies the laws of co-existence—the *status* of society—while the latter studies those of succession—its *movement*.

In comparing biology with sociology, Comte seems to have been struck with an idea which the further progress of science has demonstrated to be illusive. He frequently insists that, while both these sciences have their statical and their dynamical laws, the former are of chief importance in biology, and the latter in sociology. In other words, he conceives biology principally to consist in the study of organisms in their relations of co-existence, while he regards the study of what he denominates the *development* or *evolution* of society as the main object of sociology. This error, for such it unquestionably is, is partly to be accounted for by his failure, as above explained, to accept the development theory in biology as propounded by Lamarck and Geoffroy Saint-Hilaire, and partly by a tendency to underrate, if not wholly misconceive, the value and nature of the coexistent factors of social physics, due without doubt to an extravagant attachment for his celebrated theory of the destiny of the human race regarded as a perpetual progressive individual. This theory, which he elaborated in his later writings into a vast humanitarian system of religion, led him to give undue weight to all considerations of social progress. The advance of science has not, perhaps, reversed this doctrine of the supremacy of statical biology and dynamical sociology, but it has shown that, while the knowledge of the dynamical laws of both sciences is the chief end of their study, an acquaintance with the statical laws in the one, as in the other, is the necessary means to the sure attainment of that end. The study of anatomy and morphology constitutes only a basis from which the great practical laws of physiology and biological development can be investigated; while political economy, comparative social ethics, mythology, and religion, together with the general laws of human nature, are the elements and the data from which alone the phenomena of social development can be understood or intelligently influenced.

So far as M. Comte's views on social statics are concerned, they must be classed as generally unsound; but with him this is nothing new. He seems to possess the rare power, everywhere manifest throughout his works, of weaving upon a warp of truth a woof of error. The iron consistency of his general logic is in strange contrast with the flimsy fallacies that fill out its frame-work, and stare at the astonished reader from every page. He is a great general in the army of thinkers, but, when he descends, as he continually does, to meddle with the brigades, regiments, and platoons, he throws them into confusion by the undue severity and amazing stupidity of his commands.

He sets out by declaring the natural sociability of man, a statement which he would have long hesitated to make had he better understood man's true biological history and origin. In this connection, he very naturally condemns the "necessary irrationality of the strange doctrine which derives the social state solely from the fundamental utility which man received from it for the satisfaction of his various individual needs," and dogmatically asserts that "the essential spontaneous sociability of the human species, in virtue of an instinctive *penchant* for a life in common, can in no way be henceforth contested."

On the subject of man's moral nature as a fact favorable to the possibility of a social state, he expresses views which remind one more of a modern theologian than of the founder of the great doctrine of altruism. Man is naturally a moral being. His sympathies with the sufferings of others prompt him at all times to act for the good of society. These views, and all others to which he commits himself, are only calculated to show how little he knew of the history of savage races, and how thoroughly he was capable of perverting that history, since, if its facts prove any thing, it is that in the lowest grades of human society no true ethical principles are recognized.

He considers the family as the true social unit, the nucleus of which is the simple pair, a man and a woman. In the family he recognizes two kinds of subordination, the subordination of age and the subordination of sex. The child is subordinate to the parents, and the woman to the man.

Comte's views of the relations of women to society are simply execrable. Marriage should be perpetual. Every effort to loosen its bonds is regarded as a step in the direction of anarchy. Woman is the complete and absolute slave of man, and placed by marriage under his perpetual tutelage. She is considered as in a state of continual childhood (*enfance continue*). To support this view, he attempts to appeal to biology! This was ludicrous enough in his day, but what would be thought of it now after the law of sexual selection has become known, showing that superiority of the male in any respect, where it exists, is due to the very preferences of females themselves?* Not here alone, but every-where, he seems to lose sight of the fact that, in society as well as in biology, whatever we actually see existing must be taken as the final result of an immense concourse of circumstances, and grand conflict of forces, of which, so far as it can be statically considered, this existing state of things exhibits simply the condition of equilibrium. Not less the apparently inferior condition of women, than the different size and color of the sexes of many birds, has resulted from a long train of circumstances, which, could they be justly assigned a moral significance, would be little flattering to the male element. It is forgetfulness of this same truth, too, which inspires in Comte that undue admiration which he evinces for what he regards as the marvel of the social order itself. The variety and multiplicity of conflicting elements, whose failure constantly to destroy and annihilate one another seems to him so miraculous, have been the result of a prolonged process of adaptive inter-operation, which has worn away more and more the rough angles of friction until we have society as we see it, and which, after all, need inspire us with no inordinate sense of respect or astonishment. Not only is it still a prey to perpetual collisions, but its whole theory is interwoven with a thread of falsehood.

Passing now to social dynamics we find Comte once more

* This idea has been considerably dwelt upon by modern biologists, from how false a stand-point will be shown in other parts of this work (vol. i, pp. 657, *et seq.*; vol. ii, p. 616).

on the high plane of consistent logic. He has even caught a glimpse of the great law of the social forces of which Hobbes* gave out an adumbration. "In our social infancy," says he, "the instincts relative to material preservation are so preponderant that the sexual instinct itself, in spite of its coarse primitive energy, is at first essentially dominated by it."

Another condition which tends to produce social progress is the perpetual struggle between the essential attributes of humanity and those of mere animality, the gradual encroachment of the intellectual powers upon the domain of the passions in influencing human conduct. These are the primary elements. There are, however, secondary ones, one of the most important of which is the phenomenon of *ennui*. Whenever a being possessing highly developed organs is for any cause restricted in their use, this mental state arises, and, unless relief is afforded, becomes one of the most intolerable of sensations. In its struggles to free itself from this oppression the organism will develop enormous energy and accomplish results otherwise unattainable. The susceptibility to this feeling is proportionate to the degree of development of the organism, and especially to its intellectual development. Man is, therefore, chiefly subject to it, and in his efforts to escape from it achieves many important results.

It is to such impulses as the above that Comte seems to attribute whatever advancement man has thus far made. He rightly says that the two stages (theological and metaphysical) through which he has thus far been passing were little conducive to progress, and only looks for any further great advance to the third or positive stage upon which he has just entered.

The theological stage was the period of order without progress; the metaphysical stage, at least in its later developments, tended to destroy the social order without setting up any new condition of progress. The positive stage is destined to establish a new order, which, unlike the theological

* "Human Nature," English works, vol. iv, London, 1840, pp. 67, 68.

one, shall be in perfect harmony with the greatest degree of advancement. In the theological *régime* a mostly statical condition was preserved by reason of the enormous friction of the machinery for maintaining order. The positive *régime* is to avoid this friction.

Among the most eminently sound of all the doctrines contained in the works of Comte must be classed those upon the subject of education. Separated from their connection with government, it would seem that every honest mind would be forced to give its assent to teachings so obviously just and undeniable. Although he has left these considerations out of their natural place in the chapter on social dynamics, and preferred to introduce them in his general discussion of the method of positivism, they are none the less the vital part of his whole theory of human progress. First of all, after insisting that all education be positive in its nature, he demands that it be extended to all mankind, and no longer restricted to an imaginary aristocracy. "It will be important never to forget that this system of positive education is necessarily destined for the direct and continuous use, not of any exclusive class, however large it may be supposed, but of the entire universality of the people throughout the whole extent of the European republic. . . . Nothing is better adapted profoundly to characterize the present anarchy than the shameful indifference (*incurie*) with which the upper classes to-day habitually consider this total absence of popular education. . . . Thus the first essential condition of positive education, at once intellectual and moral, considered as a necessary basis of a true social reorganization, must certainly consist in its rigorous universality." He declares for the invariable homogeneity of the human mind, and says truly that the lower classes have far greater need of a public education which their private means can not supply, while they are at the same time much more exposed to those injuries which can be avoided only by increased intelligence.

Another point in Comte's system of education upon which he insists with great justice is, that the acquisition of knowledge shall proceed in the order of the scientific hierarchy. If we admit that his six categories as arranged by him represent the true order of the phenomena of nature, we can scarcely deny that this also indicates the proper order of their study. If we change the order, the principle is not changed. But, whatever latitude might have to be allowed in the curriculum of a system of education as growing out of practical consideration, this much should at least be strictly observed, and it is this upon which Comte lays the chief emphasis—namely, that no teacher should be allowed to attempt to expound the laws of a science more complex than his specialty, and that no one should be held competent to teach any science who has not first made himself familiar with all those which come before it in the system.

The astronomer must be a mathematician, but he must not pretend to teach physics; the biologist must be acquainted with mathematics, astronomy, physics, and chemistry, before he is qualified to expound the laws of the great complex science which rests upon all these; while the sociologist must be all this and a sociologist besides, otherwise he can not understand the full nature and scope of social phenomena. Of course, it is not insisted that he should know all these sciences equally well or in all their details, for this would be a superhuman achievement, but the general principles of all the antecedent sciences he considered necessary to be thoroughly comprehended in order to qualify one to instruct in any one of them. This may seem a very severe standard, but, unless we deny the subordination of the sciences, there seems no escape from its logic. And if we consider the vast advantage which the erection and enforcement of such a standard would secure to education, we may well believe that it would more than repay the costs. At least as an ideal system it holds up something for our contemplation, against which the only cry we can raise is that of impracticable.

With regard to the first prohibition, as a mathematician himself, Comte saw the utter folly and silly pedantry of attempting, as many were in the habit of doing, to apply mathematical formulas to problems belonging to the complex sciences whose phenomena were not yet sufficiently known to render any such application at all warrantable or even rationally possible, and he very justly and very severely rebukes all such vain charlatanism. But, in his own attempt to lay down the principles of sociology, he laid himself open to the same class of criticism through his ignorance of biology. Still, every fair critic would generously overlook these slips, considering the infancy of the one and the extreme youth of the other of these sciences. As regards the latter prohibition, the utter incompetency of so many scientific men and so-called specialists to deal with the legitimate problems of their own branch of science, in consequence of their total ignorance of all those branches upon which it rests, is a fact of common observation to-day as it was half a century ago. It is by this means that science is robbed of its choicest results. The power of co-ordinating facts can only be acquired by their study in relation to more general truths. These general truths are to be found, not in the science to which the facts belong, but in the more general sciences to which this is subordinate. In a word, the details of each science can only be generalized by referring them to the laws of the science next above it in the hierarchy.

This, then, is the cause of the greater part of that sterile specialism, that empty zeal for the multiplication of independent facts, of species, of mere names, which, even in our own day, passes current for true technical science. It is because specialists know nothing of the more general sciences upon which their special branch depends, because it is vainly supposed that a great complex science can be studied alone, and that the pupil just out of the village school is qualified to select at his own pleasure any one of the great fields of investigation that lie before him.

Comte does not, as he might have done, enumerate under this head that most patent and glaring of all violations of this principle, the notorious ignorance of legislators in all branches of science. His profound contempt for *pedantocracy* was coupled with a firm conviction that philosophers, however sound, are necessarily unfit for legislators. But he evades the real issue, which is, whether a sound education in all the successive sciences, and including all that is really known of social science, can do any harm to the man whose whole life is to be practical work in this highest field. Learned men as well as unlearned are of all shades and casts of mind. In the one class as in the other we have the theorizer and the practical matter-of-fact man of business. Which is better, an ignorant theorizer or an instructed politician? or if, as is always the case, we must have both classes among law-makers, to have them all well informed or all uninformed?

Comte's celebrated theory of a scientific priesthood in imitation of the Roman pontificate, a *spiritual power* to rule over all questions of an intellectual character, including that of education, to be supreme in its own sphere but not allowed to meddle with the temporal powers below it, which were to be controlled by practical diplomatists and trained representatives of the various commercial and industrial interests of society—this great system of his to which he devoted his later life has been almost unanimously voted a chimera. The intellectual and material concerns of society will commingle. Education and labor can not be divorced. But with this system falls the last argument against the high expediency of a thoroughly learned legislature.

The legislature is the voice of society. To speak for it, it must represent it; to represent it, it must understand it. To understand society is to be acquainted with the science of sociology. Politics, now a mere trade, which, as Blackstone says,* seems not to be supposed even to require any appren-

* "Commentaries," Introduction, pp. 9, 27.

ticeship, is, when properly appreciated, the highest and most refined of all the scientific professions, to which no aspirant should be admitted who is not master of the whole field of recognized science. On that high plane let the theoretical and the practical mind meet, and no one need fear the result.

Comte is no advocate of *laissez faire.* Indeed, his whole work may be characterized as an argument against that doctrine. His eminently just and philosophical definition of the true criterion of all real science as its ability to foretell future unknown results from the co-ordination of present known phenomena, becomes, when applied to the last and greatest of the sciences, identical with the doctrine so constantly advocated in this work, that the future of human society is in its own hands, and that a great and rapid progress can be artificially attained through clear and accurate scientific foresight of the necessary effect of present human modifications. If sociology is a science, there can be no escaping this conclusion. We know that by precisely these means man has artificially modified the results of the operation of law in all other sciences, even down to biology, and there can be no longer a doubt of the same power over sociological phenomena. This is the department of active social dynamics, or *sociocracy* (vol. i, p. 60), which Comte dimly saw, but which his successors have thus far failed to recognize.

As the historical part of the work has been already briefly sketched, this need not be here repeated or enlarged upon, and we are prepared to dismiss the formal consideration of Comte's system of philosophy. As the founder of the science of sociology, as the first to establish the true principle of the natural dependence of all the sciences, as the man who has thus far alone undertaken to classify the history of human thought according to the fundamental conditions of the mind, and to assign a generic name to all those intellectual processes which converge to develop the scientific method, and, finally, as the great pioneer champion of universal education,* the one form of modification of social phenomena certain to result in benefits which can be scientifically predicted, the world is surely under heavy and lasting obligations to this somewhat erratic philosopher.

* "Philosophie Positive," vol. vi, p. 504.

CHAPTER II.

BRIEF SURVEY OF THE SYNTHETIC PHILOSOPHY OF HERBERT SPENCER.

Herbert Spencer's rank as a philosopher—Reasons for selecting the systems of Comte and Spencer as the special subjects of these sketches—The Comtean and Spencerian systems compared and contrasted—Spencer's *laissez faire* proclivities—Laws of evolution as formulated by Spencer—His two categories, the unknowable and the knowable—The unknowable—The knowable—Co-existence and sequence—Matter—Persistence of force—Rhythm of motion—Redistribution of matter—Instability of the homogeneous—Multiplication of effects—Segregation—Equilibration—The "Principles of Biology"—Chemical laws underlying biological phenomena—Definition of life—Nature and effects of the environment—Antagonism between growth and reproduction—Direct and indirect equilibration—Morphological correspondence of organism with environment—Theory of population—The "Principles of Psychology"—Rank of the work—Physiology of feeling—Derivative intellectual processes—Proof of the reality of an external world—Vivid and faint series of psychic phenomena—Realism—The "Principles of Sociology"; notice of vol. i—Ideas of savage and prehistoric man—Mr. Spencer's ghost theory—Ancestor-worship—Animal-worship—Plant-worship—Conceptions of deity—Society compared to an organism—Systems of government or headship—Forms of marriage—The "Data of Ethics."

Mr. Herbert Spencer has received, and probably deserves, the title of England's greatest philosopher; and when we reach England's greatest in any achievement of mind, we have usually also reached the world's greatest.

The work of the true philosopher is pre-eminently the synthesis of human knowledge. To accomplish this work he must possess, on the one hand, the greater part of the general knowledge of his age, and, on the other, the special faculty required to co-ordinate it. Rarely, indeed, are these qualifications combined in a single mind. It has been the misfortune of philosophy that the most of the truly logical minds have been deplorably lacking in the necessary data upon which to exercise their reasoning powers, while many of the minds that have taken pains to acquire extensive information have proved wholly incapable of making any rational use of it. We have, therefore, had logicians and speculators on the one hand, and erudites and specialists on the other.

Among the few who have sought to base philosophy upon known facts may be mentioned first of all Aristotle. He certainly had a disposition to acquire real knowledge and to make it the foundation of his general speculations, and, considering the state of the world in his time, and all the circumstances of the case, he must be credited with having done remarkably well. From the time of Aristotle to that of Bacon and Descartes, who singularly enough were contemporaries, nothing was produced that answers to this criterion of philosophy. The efforts of these men were, however, decidedly of this character, and, though neither of them possessed all the real knowledge of his time, still both sought to make what they had available, and advocated the extension of phenomenal truth as the groundwork of intellectual exercise and the test of certainty in opinions. Bacon's ignorance of mathematics and *penchant* for physics were well supplemented by Descartes's truly profound talent for the former, which atones for many of his speculative vagaries. Although neither of these two men ever made any great discoveries in physical science, the healthy tone which their works exerted upon human thought must be credited with producing a large share of the impetus which civilization received from about that date, and which has been accelerated with each new application of the scientific method more or less distinctly formulated by them.*

* It has become quite customary for scientific writers of late to cast aspersions upon Lord Bacon and his works, and to intimate that what has been called

From the epoch of Bacon and Descartes no further contributions to the philosophy which rests exclusively on the known were made until the appearance of the "Philosophie Positive" of Auguste Comte. This statement does not, of course, ignore the great epoch-making labors of Galileo, Newton, Humboldt, and Lamarck. These were but the *fruits*, as it were, of the "Instauratio Magna" and the "Principia Philosophiæ." These men were scientists rather than philosophers, and although the important results reached by them were due to their power of co-ordinating the facts within their respective spheres of research, still none of the works produced by them can be properly described as embodying a philosophy of the universe. Newton no more attempted to connect astronomy with biology than did Lamarck biology with astronomy, while Humboldt's "Kosmos" is scarcely more than a compilation of the data existing at his time. Though he constantly talks of connecting the sciences into one vast whole, the Cosmos, still he utterly fails to point out the fundamental laws of their relations.

Comte's system, on the contrary, is truly a system. It really seeks to co-ordinate the sciences. It makes a bold and gigantic stride across the whole field, and, allowing for certain defects, which have for the most part been pointed out in the previous chapter, it realizes more nearly than anything that had preceded it the ideal of a true philosophy.

But with Comte the data were still very deficient. His

his system is wholly impracticable and useless. This results from confounding what has heretofore been commonly and not improperly known as the Baconian method with the system which he has drawn up in his "Novum Organum" for arriving at certainty in physical experimentation (Book II, Aph. xi). That this last is of no practical value all admit, but this does not invalidate any of Bacon's claims as the founder of the true scientific method. He may not have perceived it as clearly as scientific men now do, but that its chief principles formed a fundamental basis for his entire philosophy may be clearly gathered from numerous passages (see "Distributio Operis," pp. 214, 221, of American edition; also, Præfatio to "Novum Organum," pp. 234, 237; also, Book I, Aph. ix, xiv, xix, cxxiv; Book II, Aph. xxxvii, etc.).

laborious life rendered it impossible for him to acquaint himself with the known facts of his time. The details of his system are, consequently, very imperfect—often, as already shown, erroneous. His great service, therefore, was to lay out the general scheme, and sketch the most comprehensive and fundamental laws. The best-founded charge that has been or can be made against it is that it was crude. A universal philosophy had been founded. It remained to be improved and perfected.

This duty has seemed to devolve upon Mr. Herbert Spencer, and no one can challenge his qualifications for its performance. His mastery of all branches of human knowledge has been justly styled "encyclopedic." His causality has never been equaled. To him were thus secured the two essential conditions for accomplishing the permanent object of philosophy—the synthesis of science. Without the comprehensive survey which his laborious investigations have secured for him, his great combining powers would have been profitless; without those powers, no museum of facts, however well learned, would have yielded the broad principles of a cosmical philosophy. Of the former of these statements, not only all the great minds of antiquity, but such modern names as those of Kant, of Comte, and of Hamilton, are obvious examples; while of the latter, the life of Humboldt is, perhaps, the most conspicuous proof; although, within more restricted limits, the scientific world offers a multitude of instances in which the capacity for observation vastly transcends the power of co-ordination.

From the array of great names which philosophy and science have given to the world, I have singled out those of Auguste Comte and Herbert Spencer as the subjects of these brief sketches, not so much in consequence of any assumed pre-eminence in these two men above others, as because they alone, of all the thinkers of the world, have the merit of having carried their generalizations from the phenomena of inorganic nature up to those of human action and social life.

Of all the philosophers that humanity has brought forth, these two alone have conceived and built upon the broad principle of the absolute unity of Nature and her laws throughout all their manifestations, from the revolutions of celestial orbs to the rise and fall of empires and the vicissitudes of social customs and laws. This grand *monistic* conception is the final crown of human thought, and was required to round out philosophy into a form of symmetry, whose outlines, at least, admit of no further improvement.

While disclaiming all invidious comparison of the relative merits of these two great philosophers, it will be in strict furtherance of our avowed object of tracing the history of the ideas and methods which have led to the present state of sociological science, to inquire in how far the two greatest champions of the new science have been able to follow the same lines of investigation and the same canons of logic; and also to point out in what respect these lines have diverged. Thus only shall we be able to weigh intelligently the reasoning of each, and build up a consistent structure for ourselves.

Mr. Spencer has been at great pains to explain to the public, from time to time, that all attempts to identify his system with that of Comte, or to make him out as in any sense a disciple or follower of the French philosopher, are wholly unjust and erroneous, and founded on a complete misunderstanding of one or both systems.* This is entirely proper, though, it may be added, wholly unnecessary for those at all acquainted with both these philosophers. But when he goes further, and expressly repudiates the chief characteristic parts of Comte's system, and says, "from every thing which distinguishes Comteism as a system, I dissent entirely," the readers of the works of both must be allowed to place such an interpretation upon his words as seems in all respects to comport with the facts. Indeed, from a note appended to page 74, Volume I, of the "Principles of

* See his letter published in the January number of "The New-Englander," 1864 · also, note to page 74, vol. i, of his "Principles of Biology."

Biology," it may well be doubted whether he was justly entitled to make such a sweeping disclaimer, for he there admits that his direct acquaintance with the works of Comte is limited to the first half of his "Positive Philosophy." * It is thus wholly possible that a great part of Comte's system might coincide entirely with his own views arrived at quite independently. It certainly would not be strange that the only two minds that have ever risen to the grasp of the unitary principle of nature should build upon the same foundation a somewhat similar superstructure. Independently of this, however, let us endeavor to see what relation the most general principles of the two systems sustain to each other.

We have already seen that, upon the most general of all philosophical conceptions, the ultimate unity of all the processes of nature, Comte and Spencer are at one. It is not enough to say that others have held to the same truth. No one before Comte had made it the basis of a system of philosophy. Judged by any other standard, all claims to originality in any thing would be invalidated. To do this would be like awarding to the American savage the merit of discovering the New World. But let us see what is the full meaning of this fundamental principle. From the physical laws that govern the inorganic world to those that preside over the movements of enlightened social centers, there is a chasm hitherto regarded as absolutely impassable. Contemplate, then, the hardihood of the great positivist in deliberately expounding the laws of "social physics"! Think of the rigorous monistic consistency that led him to reject psychology as distinct from biology! Every reader of the "Philosophie Positive" well knows that its author regarded the process by which this chasm was closed by nature as a process of *evolution*. For, although he did not undertake to formulate the laws of the redistribution of matter, the dif-

* Previous to writing his "Study of Sociology," Mr. Spencer seems to have acquainted himself better with the Comtean system, and, as a consequence, he speaks of certain parts of it in a much more respectful tone (chap. xiv).

ferentiation of living forms, and the development of nervous systems, he none the less distinctly maintained the claims of law and progressive evolution through all these manifestations of nature's operations.

Nor are these two philosophers very widely at variance in the order in which they conceived this progressive movement to have proceeded. Both saw that evolution begins with inorganic matter and ends with human society. If Comte has omitted to introduce a separate treatise on psychology, it was in consequence of the severity of his logic, which refused to separate the brain from the nervous system, the man from the animal. He declares man and his achievements to be the simple prolongation of the animal series of forms and activities, and with almost theatrical effect disposes of psychology as "transcendental biology." A far less valid excuse has Spencer offered for his omission of any systematic treatment of the phenomena of inorganic evolution, viz., insufficient time for its elaboration. Had he written such a work, it can scarcely be doubted that he would have found himself compelled to adopt substantially the order of development set down by Comte. We can only say that, so far as the two philosophers have made known their views on the order of development in nature, they are, to all intents and purposes, in harmony. The degree of importance which each has respectively assigned to the different stages of evolution has indeed been different, if we are to judge by the length to which they have been treated, but there is reason to suppose that this was due, in great part, to particular circumstances. The plan of Comte was made from the beginning, and strictly adhered to throughout. The course of evolution was, for convenience, marked by stages corresponding respectively to the five fundamental sciences—astronomy, physics, chemistry, biology, and sociology. These sciences, it will be observed, are more nearly distinct than any others. If they have any vice, it is that of overlapping, and that is only the natural result of an attempt to fix limits to nature's operations, which are never separated by definite boundaries. These five stages he styled the "categories," to some one of which every phenomenon of nature may be referred. The order of these stages, it will be further seen, is the natural one. Mr. Spencer does not deny this.* On the contrary, he virtually adopts it. In his "First Principles" he repeatedly illustrates his laws of the redistribution of matter from the various known sciences, and, in doing so, he usually adopts substantially the order of Comte.

This work must be taken as embracing his views on the evolution of inorganic matter. When he comes to take up a department more specifically, he begins with biology, apologizing, however, for having been compelled to omit two volumes of his philosophy treating of the evolution of inorganic matter. Between his two volumes on biology and his treatise on sociology, he interpolates two volumes on psychology. These occupy precisely the place of Comte's "Transcendental Biology," and would not have suffered in their intrinsic merits, which are very great, had they been designated by that name. For Comte by no means intends by the term transcendental, as thus employed, to deny the legitimacy of this study as true scientific ground. He meant only for the time being to label them *ignoramus*, not *ignorabimus*. And here, again, the harmony between the two philosophers is quite remarkable. Both recognize the absolute dependence of mind upon body, and both perceive that the nervous organization, of which the brain is recognized as only a part, is the one biological fact to which all psychological phenomena must be referred as their immediate antecedent. And, when we consider the immense progress which the students of nerve phenomena had made between the pe-

* He only denies that man has cultivated and perfected these sciences in precisely this order, which is quite another thing from their natural dependence. Historically, science has been a growth, and is affected with all the irregularities which characterize every thing that has been developed. (See Introduction, pp. 72-75.)

riods at which the two works under discussion were written, we may almost assert that Comte said proportionally as much in his one chapter as Spencer in his two volumes. Both systems close with sociology; for, should Mr. Spencer live to complete his last two volumes on the "Principles of Morality," this could present nothing more than the ethical side of the great social science.*

Thus we see that the two philosophers are wholly agreed respecting the natural order of development in the universe, and this, from Mr. Spencer's own point of view, must be the primary problem for the classification of the sciences. For it is to him that is due the credit of having demonstrated more fully than any other writer the universality of the laws of evolution and the importance of making the general doctrine of evolution the basis of all inquiry into the connected phenomena of the universe. The problem to be solved, first of all, in this view of the case, was the order in which the laws of evolution regularly effect the phenomena of nature. What classes of phenomena must be regarded as forming the first and what the last objects of the evolutionary forces? Which ones must be considered as antecedents with respect to others, and which consequents? These are the fundamental problems whose solution must underlie all satisfactory attempts to classify the sciences. Sciences, in so far as they can be grouped at all, simply represent the natural groups of phenomena, and to determine the natural order in which phenomena are related to one another as indicated by their respective antecedence and sequence in the march of evolving forces, is to determine the natural order in which the sciences stand to one another, and that in which alone they can be successfully studied. Now in the classification of the sciences, in so far as this fundamental canon is concerned, we have seen that the Comtean and the Spencerian philosophies differ in no respect. It is

* The greater part of this chapter was written in the spring of 1877, or more than two years before the appearance of the "Data of Ethics."

true that Mr. Spencer has written a separate treatise on the "Classification of the Sciences," * in which he criticises Comte's system and elaborates one of his own, the apparent object of which work was to disclaim that part of Comtism and disseminate the impression that there was something wholly incompatible in the two systems. The truth is that, with the exception of some minor points of difference, the two methods of classification are not only not incompatible, but are quite independent of each other. It may be truly said that, so far from there being any disagreement between them, they are both essentially true. They are capable neither of agreement nor of disagreement, not proceeding from the same standard of comparison. The classification of Comte is a *phenomenal*, that of Spencer is a *logical* one. The former represents the actual course of natural phenomena in the ascending grades of development and the increasing stages of complexity. The latter refers to the ideal relations among phenomena as necessarily contemplated by the human intelligence. There is no more conflict between them than there would be between two modes of classifying men, one of which should be based on the color of the skin and the other upon the differences of language. So clear is this that it need be no further insisted upon. This much, however, we may say, that while the Comtean principle is common to both systems, and varies in no respect as to its precise order, but only in the degree of importance attached to some of its stages, the classification of Herbert Spencer is in

* At the time of writing the above, this work had not yet come into my hands, and my efforts to secure it had only resulted in the discovery that it was out of print. My knowledge of it was therefore chiefly drawn from his other works and from Mr. Fiske's "Outlines of Cosmic Philosophy." Recently, however (1880), the work itself has come under my notice, together with his "Reasons for dissenting from the Philosophy of M. Auguste Comte." After a careful perusal of this most interesting work, I see little reason to change any thing which has been said, and am gratified to find that several of the real points of divergence to which I had drawn attention are very clearly set forth by Mr Spencer himself.

the main his own, and constitutes a valuable contribution both to philosophy and to science. But, whether he was pleased or chagrined, Mr. Spencer was compelled to adopt the Comtean series, simply because it was the order of nature, and he was too great a philosopher to misrepresent nature one jot or tittle for the paltry credit of originality. Still, many doubtless think that he could have well afforded to rest his reputation upon those vast original achievements which none can dispute, while frankly referring to their proper source whatever great truths it was found necessary to recognize as having been already offered to the needy world by the noble thinkers who had preceded him.

Having thus shown that, in some of the most important principles on which Comte and Spencer are popularly supposed to differ widely, they are in reality in substantial harmony, it may be well in the next place to point out a few particulars in which the reverse is true, the prevailing opinion attributing harmony to their ideas where in point of fact they are broadly at variance.

As an avowed systematist, it is but natural and necessary that Comte should have had great faith in the power of the corporate wisdom of mankind to modify the condition of society by those measures which must, for want of a better term, be called political. Indeed, it becomes a leading factor of the positive philosophy to recognize the efficacy of positive law. That art is the end to which science is the means is a conception that permeates the positivism of Comte, and which finds its accurate analysis in that important principle upon which he so frequently insists, that the power of prevision is the only safe test by which true science can be determined. Nor has he failed to add to this that the chief object or utility of science thus defined is the power thereby acquired of modifying phenomena. He does not fail to supplement his maxim "See to foresee" by the equally forcible injunction: predict in order to *control.*

In short, Comte was a consistent opponent of the *laissez faire* school, which he styled a mere negative school, placing it in the metaphysical stage of the history of intellectual progress. He recognized, in its entire length and breadth, the science of sociology, to which he gave its name. Without entering upon the analysis which was made in the INTRODUCTION (vol. i, p. 56), he has overlooked neither the statical, the passive dynamical, nor the active dynamical class of social phenomena, and upon this last-named class, which carries every science into its stage of application—that of art—he has expressed himself in an unmistakable manner. Indeed, in his later utterances, made after the decline of his intellectual powers had begun, he carries his doctrine of the control of social phenomena to a wholly untenable length. But, while his system with its cumbersome details deserved, and has received, the fate of all of its class, the principle still remains, and must re-appear again and again until the increase of knowledge shall crown it with success. Meantime let us not forget that Auguste Comte has raised the only voice that has yet been heard for universal education as the primary political measure of the sociological art.

If, as has been stated by Mr. Spencer himself, and as most of the criticisms that have been made of him and his philosophy seem to imply, the impression prevails that he is a positivist in the sense of being an adherent of the French school as founded by Comte, then is public opinion egregiously wrong, and Mr. Spencer amply justified in making every reasonable effort to set himself right.

The Spencerian philosophy, so far as I have been able to detect from a careful study of it, never recognizes what I have denominated anthropo-teleological progress in society. It treats sociology purely as a science, never touching upon its active or positive dynamical phase, and confining itself almost exclusively to its statical laws. Human progress Mr. Spencer contemplates from exactly the same stand-point as that from which he contemplates the progress of biological differentiation. This is the passive stage of social dynamics, and with this he stops. He only deems it his business to investigate the phenomena of society, the laws which tend to preserve it from destruction, and those which operate upon it to modify it. With this view he institutes a comparison of the social organism with that of the animal or the vegetable, and to this analogy he steadfastly adheres. Nor is his avoidance of the positive ideas the result of his failure to conceive of them. He finds them perpetually intruding themselves into the field of his reasoning, and he taxes his ingenuity in dexterously baffling them and chasing them from the forbidden ground.

In an early work which can not be justly classed as a part of his philosophy proper—his "Social Statics"—he has taken strong ground against all attempts on the part of government to ameliorate the condition of society, and may be said to have fairly identified himself with the school of *laissez faire* philosophers. But in his more recent works he has greatly modified the views there expressed, while nevertheless steadily declining to recognize strictly positive doctrines. A remarkable fact in this connection is the open and somewhat bitter hostility to state education which he manifests in the "Social Statics," and which he has not, so far as I am aware, either withdrawn or qualified in any later work.

Thoroughly disgusted by the ridiculous failures he was compelled to witness in the short-sighted attempts of a sporting gentry and superficially educated nobility to legislate for the removal of evils and the attainment of benefits in society, he naturally enough drew the hasty conclusion that these were not the legitimate functions of government, and labored successfully to show how much better society regulates itself than Parliament can regulate it. And, having settled that question to his own satisfaction in his early literary career, it was naturally difficult for him to re-open it, not to say to reverse his conclusion in later years after a more comprehensive survey of the field before him.

Mr. Spencer has not, however, been guiltless of the charge of having proved too much. The evil effects which he has ascribed to this legislative meddling are sufficient, coming from so high a source, to demonstrate the general principle that there is power in positive law, and this is the sole admission the positivist requires (*supra*, p. 36). In his later writings, particularly in his "Study of Sociology," Mr. Spencer, as already stated, has modified, without retracting, these views as put forth in his "Social Statics." He justly complains that governments are continually regulating just those things which will regulate themselves much better, and neglecting those measures which are necessary to secure the due preservation of the social order. Still, in all the wholesome lectures which he reads the modern legislator, there is an unmistakable trace of the spirit of hostility to the doctrine itself of progressive reform through legislation. He nowhere goes back to principle, and openly admits that, assuming the wisdom and good intention of the legislator to be all that is desired, the natural, or passive, progress of a people could be hastened by active legislative measures. If he mentally recognizes such a possibility, there are no such measures of which he feels qualified, in the present condition of social science, to predict the success. He has in his own mind openly decided adversely to the claims of state education as such a measure, and this is the principal one in which unqualified confidence is expressed in this work. Could I be convinced, as he doubtless is, that this too would fail, I should occupy a position but slightly different from what I conceive his to be. I should not in the least yield the *a priori* principle that legislation is to sociology what invention is to physics, and that, if progress is ever to become anything more than passive and secular, as we see it in the evolution of worlds, of plants, and of animals, the quality of positivity and extra-natural speed must come through what I have called political action. And I should enjoin all who desire to see humanity improved to labor for that end in precisely the same manner as they labor in all the remaining fields of science, to investigate the laws of social order and social progress, in the hope that light would eventually dawn, and that a clear course would ultimately be revealed, in which such measures of artificial progress might be adopted with safety and carried through with success. These views I should be compelled to hold because there is no alternative but to renounce all effort and trust to the slow laws of cosmical evolution, and also because experience in all the other fields of science shows that this is the normal condition of things, and that, if sociology is really a science, the same attitude should be assumed toward it as has always been assumed toward other sciences, if anything like analogous results are to be expected. But, if there were presented no single step by which to initiate a course of procedure, it may be doubted whether it would be deemed worth while to elaborate a treatise whose only object could be to urge on a work, the ultimate success of which could only be foreseen by the eye of reason, as a dim, shapeless something, whose very distance could not be known. Mr. Spencer seems to me to have labored under mental conditions similar to what I have described. Rejecting as chimerical all the positive systems thus far set up, yet firmly believing in the reign of undeviating law throughout the whole domain of human activity, he recognizes the paramount necessity of entering at once, and in earnest, upon the work of exploring this realm and of investigating the phenomena and laws of social existence, subject to the same canons and by the same methods that have been successfully applied to other phenomena and other laws.

The more we examine the situation the more clearly we shall see that this was precisely the attitude that the condition of the science at the time demanded. Theological positivism had been a success only in maintaining its hold on mankind during a long and dark period. As a means of increasing the natural progress of the race it had proved a failure. The metaphysical negativism that succeeded it had demonstrated, by its tendency to anarchy, both intellectual and political, that some positive system was demanded, and threatened a return of the odious theological *régime*. The Comtean system was too chimerical and preserved too many relics of theological tyranny to permit it ever to receive a trial. Government, both on the Continent and in England, was reverting to the policy of aggressive legislation, but the quality of the legislators everywhere was such as could result in nothing but failure in all attempts to improve the condition of society. Science had achieved a complete triumph over all the fields of inorganic nature, and the reign of law had been demonstrated throughout the domain of mechanical and physical forces. The undulatory theory of light, heat, etc., had been followed by the discovery of the law of the correlation of all forces known to exact science. Lamarck, Geoffroy Saint-Hilaire, and Dr. Erasmus Darwin had striven to bridge over the chasm that separated the inorganic from the organic world, and introduce law into the world of life. The great truth that all phenomena were mutually dependent, and that every fact was but the last link of a chain reaching back into the unfathomable past, had dawned fully upon the age. The questions whether life was also a part of nature, whether man was the product of ages of slow development, whether language, custom, civilization, society, were not also subject to law and fruits of cosmic evolution, were before the bar of human judgment for decision.

It was under these circumstances that Herbert Spencer came upon the stage. He looked over the field. His eye caught the salient points. He saw that the first requisite was knowledge. He obtained it. He then proceeded to compare it. Under every point of view one fundamental law of nature stood boldly out. That law was *change*. Restricting his view, a second law presents itself, subordinate only to the law of change. This law is *progress*. The elements of all phenomena are perpetually changing their position. This change is in a fixed direction, and not arbitrary. That direction is from the confused and homogeneous toward the definite and heterogeneous. This is the test of progress. It is the process of evolution. The opposite tendency is dissolution, and must be assumed to be going on in some parts of the universe in such a manner and degree as exactly to balance the changes of evolution. In our system, and certainly on our planet, however, the law of progress has long prevailed, and seems still to prevail. All change is due to the motion of matter. The process of evolution consists in the integration of matter and the dissipation of motion. That of dissolution consists in the integration of motion and the disintegration of matter. The living forms found on the globe when compared with those found fossil in the rocks prove that the law of evolution has prevailed, and must be called in to account for the great progress attained. Man himself is a product of this all-pervading and long-continued progress. Human languages, when systematically compared, show that the same law has prevailed also in that department. History and archæology combine to demonstrate that civilization has formed no exception. Society, therefore, is itself a product of evolution. But, as all forms of evolution are subject to uniform laws, Science becomes mistress of all fields of phenomena. Biology has a legitimate existence, and sociology takes rank as a true science. Such is the primary conception of the Spencerian philosophy.

We will now rapidly review the principal outlines of this system. Most readers are, no doubt, familiar with his works; but, partly to complete the symmetry of our plan, and partly because such a casual survey may contribute somewhat to its elucidation, let us more specifically consider the philosophy of Herbert Spencer.

Mr. Spencer acknowledges but two categories, the *Unknowable* and the *Knowable.*

The Unknowable is the Absolute, or Unconditioned; the Knowable is the Finite, or Conditioned. The former is the legitimate domain of *Religion;* the latter, of *Science.* For all time there has existed a conflict between Religion and Science. The cause of this conflict, like that of conflicts between adjoining states, has been *disputed boundaries.* The only possible reconciliation, therefore, must consist in a settlement of this question of boundaries. Such a settlement he conceives to be the final recognition of these two categories, and the assignment to Religion of the region of the Unknowable, and to Science of that of the Knowable.

Perhaps no more equitable award can be made, and both parties will probably be ultimately compelled to accept it and be satisfied; still, on first view, it vividly recalls the manner in which the man is credited in the story with dividing his house with his wife, taking the inside for his portion and allotting the outside to her.

Throughout the varied and conflicting forms of religious belief, there is one truth, and but one, that underlies them all. This truth is, that there exists a something which the finite intelligence does not and can not comprehend. That something is the Absolute, the Unconditioned, the Unknowable. This is the foundation of all religion, and, as it is for ever safe from all the encroachments of Science, it insures to Religion a reign of perpetuity.

To establish this truth, Mr. Spencer goes over the field of metaphysical speculation, reviewing the scholastic doctrine of mediæval times, the "Antinomies" of Kant, and the contradictory propositions of Sir William Hamilton and of Mansel. He arrives at the relativity of all knowledge on the one hand, and the actuality of the non-relative on the other. The Absolute and Unconditioned is not a vague conception that we may put equal to zero. It is a reality of the highest certainty, and forms the basis and the substratum of all comprehensible truths. As such, it is worthy of all worship, and a fitting object of religious reverence. This basis of reconciliation, therefore, for the conflicting interests of religion and science, is not as unequal as it might at first appear, and must certainly be recognized as the most satisfactory plan of settlement yet proposed.

Leaving the domain of the Unknowable to religion, to which it belongs, Mr. Spencer enters the realms of the Knowable as the domain of science and also of philosophy. He closes the chasm supposed to exist between science and philosophy by defining the latter as "knowledge of the highest generality." And as science is only another word for knowledge, so philosophy is only a certain kind of knowledge. The particular kind of knowledge constituting philosophy he recognizes as the knowledge of the relations which phenomena sustain to one another. Science, therefore, properly understood, is the generic term, and includes both a knowledge of phenomena and of their relations.

Predicating the reality of the Unknowable, the Knowable must be regarded as simply the varied manifestations of the Unknowable. The distinctions among these manifestations constitute the data of philosophy. The most profound of these distinctions is that between the *self* and the *not-self*. Throughout all the forms of contemplation of that which appeals to consciousness and to sense, there is this ever-present duality which separates the subject from the object, the thinking from the thought. As on the one hand the confusion of object with subject is the great cause of error in the world, so on the other hand false conceptions of their relations have led to the denial of one and even of both. Philosophy is impossible without the unquestioned postulate of the reality of both *ego* and *non-ego*. Reality is defined as persistence in consciousness, and with this test not only can things known to sense be established as realities, but the Absolute and Unconditioned, that which makes these real, is accorded a still higher degree of certainty.

Thought is a comparison of relations. The two fundamental standards of this comparison are those of co-existence and of sequence. Relations of co-existence take place in space, those of sequence in time. All phenomena that correlate the subject with the object do so under one or the other of these relations. Matter is simply the resistance of co-existent points of space. All the properties of matter are reducible to this one of resistance, and the conception of matter itself proves to be nothing else than the experience of this resistance. Motion is the change of position of these co-existent resisting points, which change takes place successively and not simultaneously. Hence motion involves space, time, and matter. Force, which is the product of the matter into its motion, is regarded by Mr. Spencer as the ultimate conception. It is the relation which involves all the other conceptions. "All other modes of consciousness are derivable from experiences of force, but experiences of force are not derivable from anything else." We may reduce time, space, matter, and motion to terms of force, but can never eliminate that term; it is the final unknown quantity in the problem of the universe, the unknowable reality which transcends all experience and all representation. Force, with Mr. Spencer, is the true first cause of all phenomena, and his adhesion to it as the fundamental reality of the universe is worthy of a religious enthusiast, while the thorough and able manner in which its claims are brought forward and established entitles him to be regarded as the founder of a new school in philosophy, which may be appropriately styled the school of *dynamists*.

It should be stated that this view is by no means accepted by all the scientific minds of the age, and is rejected by many who subscribe to the greater part of the Spencerian philosophy. My own strictures upon it must be postponed to a more appropriate place (*infra*, p. 221), where I shall undertake to show that, if not demonstrably unsound, it is at least the less plausible of two hypotheses which every one is wholly free to choose between, and one of which, it would seem, must be true.

The indestructibility of matter and the continuity of motion lead to the persistence of force, which is the fundamental *dictum* and universal criterion of Mr. Spencer's system. With him the *reductio ad absurdum* is to demonstrate that, on a given assumption, the persistence of force would be denied—a law as universal as the law of contradiction, or, as Sir William Hamilton called it, non-contradiction,* was held to be by the older metaphysicians.

However questionable or faulty Spencer's doctrine of the supremacy of force may be, it is certainly a great improvement upon the Comtean denial of the existence of force as a necessary relation of nature and conception of mind. By means of it the law of efficient causes can be as conveniently formulated as it can under the law of the *impact of bodies.* We thus have a dependence in nature, and are shown the possibility of the rational explanation, proximate at least, of any given phenomenon. As I have shown when treating of Comte's ideas, the strict adherence to the positivist conception in its Comtean purity, instead of being, as he thought, the only legitimate scientific method, would be in reality the abnegation of the scientific method by substituting mere independent *succession*, assumed to be uniform, for actual *causation* among dependent terms of a series. In the former case, even if induction should suffice to establish uniformity, all power of explanation is removed as well as all hope of tracing phenomena back along the series in search of more and more fundamental conditions of their existence. Add to this the demoralization (which the history of teleological conceptions ought to have taught us not to underestimate) due to the acceptance of any thing less than a demonstrated necessity that certain effects shall follow given causes, and the immense superiority, from the point of view of practical value, of any system, however defective in other respects, which recognizes such a necessary relation, over one that does not, may be better realized and appreciated.

* "Metaphysics," lecture xxxviii.

Still, it is difficult to perceive wherein the Spencerian conception of force differs fundamentally from Boscovich's theory of matter, which rejects the ultimate atom, and defines matter as the resistance of a mathematical point. It must be conceded that to the unsophisticated mind this bears the usual marks of all sophistry; and it may be questioned whether this fundamental dictum of Herbert Spencer's philosophy is not itself a good example of those very "pseud-ideas" whose nature and frequency in human reasoning he has so clearly described.

A return to the realistic doctrine of Democritus and Epicurus is about as certain to follow this new wild flight of reason as did the return to "Common Sense," the erratic rovings of the idealists and the nihilists. That kind of reasoning which puts every thing equal to zero which it can not directly perceive, belongs to a past age of philosophy. Mr. Spencer has successfully rebuked it in declaring for the reality of the *noumenon.* But why should he make force the basis, which is clearly a *relation*, while denying this dignity to matter, which all experience declares to be a *thing?*

The law of the "transformation and equivalence of forces" is squarely met and recognized by Mr. Spencer, who does not limit its range to what are known as physical and chemical forces, but extends it into the domain of vital and even of psychical energies.

The doctrines of "least resistance" and the "rhythm of motion" are fully elaborated, and the treatment of the latter subject offers one of the most brilliant examples of strict philosophic thinking which the world has yet produced. We are here vividly shown that, from the rhythmic movement of the pennant as it flutters in the gentle breeze to the "tidal waves" of public opinion so certain to ebb into reaction, there is always going on this universal undulation throughout the entire domain of nature.

We are thus prepared to contemplate the laws of the *redistribution of matter.*

The knowable universe consists of material *aggregates.* These aggregates are in a condition of incessant change. They disappear, and new ones appear in their places. Each aggregate has a history. The complete history of every aggregate covers the entire period of its perceptibility. This history has two stages. The one stage is from the moment of its appearance out of the imperceptible to the moment of greatest concentration and definiteness. The other stage is the remainder of its perceptible existence until it again passes into the imperceptible. The first of these stages covers a gradual transition from a diffused to a concentrated state, the second a transition from a concentrated to a diffused state. The progress from a diffused to a concentrated state is called evolution, and consists in the integration of matter and the dissipation of motion. The progress from the concentrated to the diffused state is called dissolution, and consists in the disintegration of matter and the integration of motion.

This is the fundamental law of the redistribution of matter, and applies alike to every department of science.

Evolution is *simple* when this process of the concentration of matter is unaffected or only slightly affected by external perturbing influences, that is, when the progress of one aggregate is undisturbed or little disturbed by the proximity and influence of other aggregates in different stages of their progress. It is *compound* when the proximity and influence of such other aggregates so disturbs the normal process as materially to change the rate and the course of its progress.

These laws of the redistribution of matter are universal. They are traceable from the development of a system out of a nebulous mass to that of human language and institutions.

The next great principle which is required to complete the conception of the law of evolution is that of the "instability of the homogeneous." The instability of all matter is implied in the law of perpetual change. But there is special instability inhering in diffused homogeneous masses. The universal tendency of all matter is from a condition of unstable to a condition of stable equilibrium. A pendulum illustrates this law. Inverted and ever so nicely balanced, any change, however slight, in the conditions which surround it, destroys its equilibrium, and it continues to oscillate to both sides of the center of gravity until its momentum is overcome by gravitation and the condition of stable equilibrium is attained. The homogeneous state is a condition of unstable equilibrium. The least initial impulse applied to an aggregate in this state, conceived to be so equipoised by the mutual attractions of its own particles and uninfluenced by forces from without, is sufficient to set up the changes required to destroy this equilibrium, and overthow its state of perfect homogeneity. It thus passes through states of successively greater and greater heterogeneity in its progress toward a state of completely stable equilibrium. The history of our earth affords a good example of this process. From the diffused gaseous condition in which it is supposed to have once been, its motion has gradually been dissipated while its matter was being integrated, until now only a comparatively thin outer envelope of gas exists, while the remainder has assumed either the liquid or the solid form, the last of which presents the greatest stability. And it can scarcely be doubted that this process is still going on, and that ultimately this omnipresent *eremacausis* will reduce the waters and the atmosphere to the state of stable equilibrium—a stage of planetary existence which our satellite seems to have already reached. And may not this same law be called in to explain the heterogeneity of elementary matter as known to modern chemistry? If all matter is primordially identical, is it not philosophical to assume that the sixty-five * known elements

* The number of chemical elements recognized differs with different authors. Sixty-five was the number long set down by teachers of chemistry, but, notwithstanding the alleged recent discovery of quite a number of new ones, Professor Cooke only enumerates sixty-three in his "New Chemistry," published in

represent so many states of heterogeneity which it has thus far assumed in its cosmical course from unstable homogeneity toward the ultimate condition of stable equilibrium?

It is proper to remark that, so far as regards purely cosmical processes, the ascending series is the only one observable to us. We look in vain for any sign of the incipient dissolution of the universe. Whatever theory may require, the fact ever remains that the process we see going on in our portion of space is that of evolution only. We see only the integration of matter and the dissipation of motion. We see only the tendency toward the condition of stable equilibrium. We see only the absorption of the gaseous and the establishment of the solid form of matter. All theories by which it has been sought to compensate for the radiations of luminous bodies have proved mere speculations. We *know* that the sun is radiating its heat into space. We do *not* know that space is returning this dissipated motion either to the sun or to any other center. We see planets in various stages of their progress toward the stable state. We have no reason to suppose that any are in a state of transition from the stable to the unstable state. Our satellite is supposed to have passed through all its stages from the gaseous to the solid condition. Its gases have been absorbed, its waters have retreated into its interior, and all its visible activities have apparently ceased.* The moon appears to be a dead star. It has run its long cosmical course, and has at last arrived at the final state of complete stable equilibrium. This state is the goal of the whole process of evolution. If, in fact, the moon has not yet reached this point, it is only a question of time when it shall reach it. Other planets or satellites, no doubt, have already done so, and all must eventually share their fate.

1876. In the second revised edition of Dr. George G. Groff's elaborate "Chart of the Chemical Elements" (Lewisburg, Pennsylvania, 1881), sixty-seven are enumerated.

* According to Neisan, Klein, and other selenographers, there is ample evidence that volcanic activity is still going on in the moon.

But where is the evidence that any have commenced to reverse this universal process? What star is suspected of being in a state of dissolution? Where, in all the universe, do we see solids turning into liquids, and liquids into gases? Where and how are the radiations emitted by concentrating bodies being harvested for the purpose of disintegrating matter which has reached its ultimate stage of complete equilibration? We seem bound to confess that we are justified in such an assumption only by the arbitrary extension of the law of the "conservation of energy" (which is only another way of expressing the indestructibility of motion) as established in the domain of physics. So far as the observation of terrestrial phenomena is possible, motion is indestructible, and escapes from every attempt to diminish it, under other forms whose reduction to the terms of the first has been quantitatively formulated. But are we thus justified in projecting this law into the remote regions of space where we see motion daily being dissipated but never recomposed, and have we a right to say that this motion, lost to our system, is not lost to the universe? True science well knows how here to suspend its judgment, and hand this question over to him to whom it legitimately belongs—the philosopher. But it also knows how to refrain from the hopeless cry of *ignorabimus*.*

The passage from the homogeneous to the heterogeneous is attended by a further result which Mr. Spencer designates as the "multiplication of effects." Increasing heterogeneity necessitates greater or less interference of the discrete masses. A single aggregate has become a multitude of aggregates in such proximity as constantly to impinge upon one another. Simple evolution has thus been greatly compounded by the actions of its own forces, and the consequent effects have been greatly multiplied.

The heterogencity evolved by the laws of the redistribution of matter is not wholly fortuitous and irregular. It

* These views were somewhat enlarged upon in "The Popular Science Monthly." vol. xi. pp. 672, *et seq.*

takes place in conformity with a fundamental law of selection. This law is called by Mr. Spencer "Segregation." The heterogeneous products of evolution possess all degrees of dissimilarity. The law of segregation unites those which most resemble one another, and separates those differing most. This gives a definiteness to the process. The union of the similar every-where into distinct groups tends to increase stability. It thus increases the power of the new aggregates to resist the forces of disintegration. This is the principle that underlies all organization.

Segregation, ending with organization, completes the ascending series. Each aggregate, after leaving the homogeneous mass, may still be considered homogeneous in itself. Segregation has made it so by selecting like elements of which it is composed. But there must be a limit to the process; it can not go on forever. The quantity of matter as well as of motion in the universe is always the same. No more matter can be integrated than exists for the purpose. All motion can not be dispelled from the universe. This is practically true of limited portions of space. Organization is a positive process, and can only take place under the influence of some prevailing force. That force, in our system, is the heat of the sun. Even this is approaching its stage of greatest concentration. On a smaller scale the process of evolution is being perpetually antagonized and overcome. The forces of evolution are ever struggling with the forces of dissolution, and the state of equilibrium between them is invariably, sooner or later, reached. This last process, or rather conclusion of the process, is termed "equilibration." Homogeneous aggregates are differentiated into heterogeneous collections of minor aggregates. These minor aggregates are further differentiated by the accumulation of all the like units into the same combinations. The diffused state is converted into the concentrated state. The greatest density and least volume are attained. Complete equilibrium is reached. Each aggregate has parted with all its excess of motion. Henceforth it is completely a prey to its environment. It possesses no positive force within itself. How long it will remain in this condition must, therefore, depend upon the external conditions by which it is surrounded. But, as these can integrate it no further, if they are able to affect it at all, they can only disintegrate it. This they, in fact, invariably sooner or later do.

The process of "Dissolution" begins by an increase in the movements of parts and a decrease in the movements of wholes. Molar motion having ceased and molecular motion commenced, the process of the disintegration of the matter of an aggregate continues until it has absorbed all the motion of which it is capable, and its matter has been completely separated and dispersed. As we have already seen, this process, conceived as purely cosmical, is, in the present state of our knowledge, wholly inferential. We see it going on under certain limitations in the visible world around us, but we see as yet no evidence of it in the great expanse of the heavens. Still, as our sphere of observation is so limited both in time and in space, we are left the alternative of making this logical deduction or of suspending our judgment.

It should be remarked of the law of dissolution that it must be conceived of as a constantly active principle. However much the opposite law of evolution may in fact predominate, dissolution is, nevertheless, perpetually antagonizing it. And, in the progress of almost any aggregate, there are constantly recurring periods when the quantity of motion absorbed is greater than the quantity dissipated. These are moments of reaction, the temporary triumphs of the forces of dissolution.

We must divest our minds of the current notion that evolution necessarily implies higher and higher organization. Evolution is progress toward the condition of stable equilibrium, not necessarily progress toward higher organic perfection. The stage of greatest organization is that in which the struggle between the antagonistic forces is greatest, in which the success of the one or the other is least constant. The prime of life of a planet, like that of a person, is when the forces of growth and decay are nearly balanced, but slightly in favor of the former. The period of greatest perfection of any aggregate is the period immediately antecedent to that of greatest concentration. The organizing vitality of the earth is due to the heat received by it from the sun. This is in the nature of the absorption of motion. It is this action that converts the liquids on its surface into gases. The existence of an atmosphere is due to the quantity of motion constantly being absorbed by the earth. But without an atmosphere no life could exist. It is, therefore, this agency of dissolution which renders organic progress possible on the earth. The agencies of evolution seize upon the liberated atoms and reintegrate them into new and plastic forms, and endow them with the subtile principles of life and activity, of sensation and intelligence. But when evolution shall have so far progressed that the further absorption of motion is impossible, when the solar radiations shall at length fall powerless upon the earth, and all nature shall be locked in the icy embrace of solid matter, then will all organization, all life, all mind, and all intelligence have departed for ever. Yet then only will the normal process of evolution, the integration of matter and the dissipation of motion, have run its course, and the state of complete equilibration be reached.

The above important considerations, although Mr. Spencer has failed to present them, flow as simple corollaries from his own analysis.

Dissolution forms the last act in the great cosmical drama, and completes the cycle of change. Societies are disintegrated, and the races of man scattered and extinguished.* The animal and vegetable forms are deprived of life, of organization, and their substance decomposes and passes into

* There is much truth in the saying of St. Simon, that nations and societies, as certainly as individuals, must reach their age of decrepitude and ultimate dissolution.

the gaseous form. The rocks and minerals of which the earth is composed are disintegrated by internal activities, and join the nebulous mass. All the planets, and along with them the sun, will have their materials broken up, and the infinitesimal particles to which they are reduced diffused over a vast expanse of space. Star systems shall be changed into nebulæ, eventually to begin anew the same grand cycle through which they have already passed.

Such is a brief and imperfect sketch of the "First Principles" of Herbert Spencer's philosophy. No one has yet been found to deny that they give their author a better title to the name of philosopher than belongs to any other to whom it has thus far been applied.

The "Principles of Biology."—The two volumes on the "Principles of Biology" follow immediately upon "First Principles." It has been said that Mr. Spencer's work on the "Principles of Psychology" would probably be the one on which his reputation would finally rest. This may be the popular view, since the reading public is more competent to pass judgment upon a psychological than upon a biological treatise. But to those considerably acquainted with the forms of life, and who regard a philosophical co-ordination of the laws and phenomena of the vital and sentient universe as of greater value at this time than the analysis of mental operations—to such the "Principles of Biology" can but be regarded as a masterpiece of the highest merit, and as the precursor of a new era in the study of both animals and plants.

While our space forbids any extended examination of this truly great work, a cursory glance at some of the most important truths brought out in it seems to be demanded.

Of exceedingly great interest are Mr. Spencer's remarks upon the constitution of organic matter. The peculiar and important office which the element *nitrogen* performs in the organic world is coupled in the most significant and instructive manner with evidence that all nitrogen compounds present the highest states of instability. As all vital existence depends on the power of the organized substance rapidly to decompose and recompose, the secret of the importance of nitrogenized compounds in all living tissues is apparent.

The qualities of colloid matter, of which all organic compounds consist, are compared with those of crystalloid substances, constituting the greater part of the inorganic world. The former is shown to be far more susceptible to change of internal constitution and external form than the latter—so much so as to warrant calling the colloid the *dynamical* state of all matter, as contradistinguished from the crystalloid, which is its *statical* condition. The nitrogenous colloids, of which all organized beings are composed, admit of a greater number of isomeric forms than any other known substances, proteine having as many as a thousand. The theory of isomerism is that of re-arrangement of molecules. The greater the number of isomeric forms the more numerous the possible re-arrangements of the same particles. A re-arrangement of particles is as much a change of molecular constitution as is an exchange of molecules. It implies the same quantity of motion. By this means alone can motion be generated without the renewal of matter. The mysteries of nerve-currents and of muscular contraction are thus put in the way of solution, in complete harmony with the doctrine of evolution.

Passing over this interesting question, let us notice Mr. Spencer's definition of life. When fully elaborated, it is this: "The definite combination of heterogeneous changes, both simultaneous and successive, in correspondence with external co-existences and sequences." In this definition he claims to have established a formula, under whose terms nothing else than a living organism can be placed—*i. e.*, a formula which, if anything can be shown to agree with each of its terms, will at once determine it to be a living organism. Any aggregate, therefore, which is undergoing changes of different kinds (heterogeneous) in many parts of its mass at the same time (simultaneous), and different for the same part at different times (successive), and which combines these changes in a systematic (definite) manner into a subordinate whole, and which is caused to do this by the influence of contiguous external aggregates, which are reciprocally modified by it into a state of greater or less adaptation (correspondence)—such an aggregate, without looking for any further characteristics, may be at once classed as either an animal or a plant.

Whether or not any number of such definitions, however logically drawn up, could ever aid the naturalist to decide whether a given object properly belonged to his field of research, attempts to reduce the phenomena of life to one general law, however complicated that law may be, should not be despised or discouraged on any false plea of utility. It is to *know*, that we study; and the highest form of knowledge is the generalization of nature's laws. It is a grand thing to know that there seems to be a possibility of bringing all the complicated phenomena that constitute life under a single definition. To those who complain that the definition is long and involved, it should be replied that the thing defined is vast and manifold. And, although it may still be well doubted whether this definition is adequate, or will be found broad enough to admit all the future discoveries in the science, it is yet conceded that it is an improvement on all attempts previously made, and constitutes the truest definition of life that we now possess.*

The great importance of the last part of this definition seems to have been fully appreciated by Mr. Spencer. He refers to M. Comte's theory of the necessary harmony between the organism and the medium (*milieu*) in which it lives, and proceeds to develop his own now celebrated doctrine of the complete dependence of the organism upon its "environment," a doctrine of the first importance, and whose ulterior

* The definition given in chapter iv (*infra*, pp. 318, 320, 355) belongs to quite another class.

consequences he has brought out with unequaled clearness and power in the eleventh and twelfth chapters of Volume I.

In no spirit of underrating the services of Herbert Spencer, or indeed of any one, but simply that the true history of human thought on this subject may be correctly stated, it is proper to remind the reader that the conception of the correlation of organism with environment was not only entertained by Lamarck, but that it received at his hands a somewhat extended treatment, and may be said to form one of the cardinal principles of his "Philosophie Zoologique." He adopts a slightly different terminology, and, in fact, does not confine himself very strictly to any one set of terms employed in the technical scientific sense. He makes free use of the popular term *circumstances* to imply very much the same as Mr. Spencer's word *environment.* He also frequently speaks of the medium (*milieu*) in which a creature lives, and gives to this word all the latitude which Comte subsequently assigned to it. He even seems to have occasionally foreshadowed both the Comtean and the Spencerian expression, when, wishing to convey his meaning with special clearness, he combines the two allied terms, and says, "*milieux environnants.*" * The most important chapter (vol. i, chap. vii) of this entire work bears this somewhat prolix but very significant title: "De l'influence des circonstances sur les actions et les habitudes des animaux et de celle des actions et des habitudes de ces corps vivants, comme *cause qui modifient* leur organisation et leurs *parties.*" By this expression, he meant to imply that the influence of circumstances, in modifying the organization of animals, was the remote rather than the immediate cause; that, while circumstances influence the actions and habits of animals, these latter effect the observed morphological modifications. The entire chapter is in complete conformity with its caption, and, considering the period when it was written, it assumes, in the light of modern discovery, an extraordinary interest.

* "Philosophie Zoologique," vol. ii, pp. 5, 304.

The entire subject is briefly summed up in two general laws, which contain the essential elements of the "Descent Theory." The first is the law of adaptation; the second, that of heredity. But Mr. Spencer's criticism of the presentation of Comte applies equally to that of Lamarck, that, while the correspondence between organism and environment was recognized as a condition essential to life, it was not perceived that it is in this correlation, understood in its whole scope, that life itself consists.

Fully comprehending this fact, Mr. Spencer has proposed a second definition of life, which, while less analytic, he regards as equally true, viz., "*the continuous adjustment of internal relations to external relations.*"

In his chapter on "Genesis," Mr. Spencer has brought into special prominence the important law, which had generally been overlooked, and the reverse of which is popularly held, respecting the species of antagonism which exists between growth and reproduction. Farmers and horticulturists, desiring abundant fruit, and gardeners hoping to secure fine flowers, are frequently disappointed after the greatest care in enriching their soil. A luxuriant crop of leaves, with sparing or no flowers or fruit, is too often the result. Again, all botanists, and, indeed, most observing persons, have remarked how plants and trees that have become injured by some accident usually bear a profuse abundance of flowers and fruit. Trample a stalk of corn under your feet, and, if not killed outright, its struggling energies will develop its seed far in advance of its uninjured comrades. Even a slight touch of early frost seems to admonish a plant to hasten on with its mission of reproduction. In the lower forms of animal life, too, many facts analogous to those observed among plants have been brought out.

One principle alone is sufficient satisfactorily to account for them all. So long as the forces of growth are largely in excess of the forces of decay, no reproductive processes are possible. Growth is the normal process. Reproduction marks a falling off of this power. It indicates a degeneracy of certain parts of the system. In plants, it is noteworthy that it takes place first at points most remote from the base, and hence most difficult of access to the sap. The reproductive functions, notwithstanding the mystery that surrounds them, are of the lowest biological order. The sexual products are found to consist of the simplest elements of combination—of simple cells. They become differentiated into organs of independent function, and serve to secure the perpetuation of the species when the dissolution of the individual has commenced.

Paradoxical as this doctrine at first appears, the number of facts that come forward to support it, when once presented, is almost without limit. It is one of the most important laws of biology, and its elucidation in Mr. Spencer's work shows tolerably well the advanced character and high scientific merit of this treatise, which is the chief reason for selecting it from among so much other valuable matter as a special subject of comment. Mr. Spencer has, however, in other works drawn from this law some very questionable deductions respecting the application of this principle to the human race, which will be touched upon at the proper time (vol. i, p. 657, *et seq.*; vol. ii, p. 616). There is not, however, any doubt that in man, as in the rest of nature, a natural antagonism exists between growth and reproduction.

In the chapter on "Distribution," a very important law is announced, which, like the one just examined, had not merely been overlooked by previous writers, but was then and still is to a great extent the reverse of the received ideas on the subject. This law refers to the *degree* of correspondence generally existing between the organism and its particular habitat. The popular teleological opinion of course is that plants and animals possess a perfect adaptation to the places for which they were intended, and in which we find them. Dysteleologists, without admitting a purpose, had not felt called upon to deny the fact. But no truth is better

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proved by modern science than that this adaptation is very imperfect, and no fact is more fully attested than that organisms thrive equally well, and frequently far better, under wholly different conditions from those in which they are found in a state of nature. On closer scrutiny, this fact is found to form the real basis upon which all artificial improvement of wild stocks, both of animals and plants, rests. The great law of competition, of which natural selection is the most important subordinate law, finds here another extensive application, which Mr. Darwin had overlooked, but which did not escape the vigorous generalizing powers of Mr. Spencer. This he characterizes as "the truth that each species of organism tends ever to expand its sphere of existence—to intrude on other areas, other modes of life, other media; and, through these perpetually recurring attempts to thrust itself into every accessible habitat, spreads until it reaches limits that are, for the time, insurmountable."

Mr. Spencer here catches a glimpse of the universal law which I have called "*biological statics*." *

In the last part of the first volume Mr. Spencer enters squarely upon the task of harmonizing the facts of biology with the hypothesis of evolution. He disposes of the Special Creation hypothesis in a somewhat summary but very authoritative manner, and shows, on the other hand, how completely the hypothesis of evolution accounts for all the facts that are satisfactorily understood. In doing so he considers the arguments from classification, from embryology, from morphology, and from distribution. He further shows that evolution, as seen to go on in the living world, is none other than the general cosmical process described in "First Principles." Organic evolution commences with homogeneous organic matter. The instability of the organic colloids favors

* See "The Local Distribution of Plants" in "Popular Science Monthly," vol. ix, p. 676. I there discussed this question from the facts of the vegetable kingdom, and carried the Spencerian doctrine even further than Mr. Spencer has done, being, at the time, unacquainted with his "Biology."

change in the direction of the heterogeneous. This passage from the homogeneous toward the heterogeneous in living forms is the process known as *differentiation.* The result of this differentiation is the multiplication of special organs having special functions. From the amœba, whose entire body may be said to consist of a single organ, its stomach, to the human being, with numerous distinct vessels, nerves, and muscles, well-defined limbs, and specialized senses, this differentiation is immense. Segregation here appears as the "physiological division of labor," by which all the elements of each organ are assimilated and the distinctness of the organ secured. Along with this differentiation there perpetually goes a corresponding integration. These terms are not opposites in the Spencerian sense, but correlatives. Differentiation must not be confounded with disintegration or dissipation. It is the formation of definite and distinct parts and organs, while integration is the union of all these differentiated parts into one dependent system—an organism. The more complete the differentiation, *i. e.*, the more definite, distinct, and numerous the special organs, the more firm will become their dependence upon the organism, considered as a whole or unit. Thus the degree of integration increases *pari passu* with that of differentiation.

Finally, the organism, like all other aggregates, reaches a limit to its capacity for differentiation and integration, and becomes equilibrated with the forces of dissolution. Its decline then sets in, and dissolution eventually becomes complete; the tissues and organs become disintegrated, death ensues, and decomposition dissipates the matter of which the organism was composed into the elementary gases of the earth's atmosphere.

Let us here again note the important fact, overlooked by Mr. Spencer, that the original office of the sun's heat, instead of being that of the evolution of life, is the dissolution of organic forms. It is by the absorption of a portion of the sun's molecular motion in the form of heat that a corresponding portion of the earth's matter is disintegrated and dissipated in the form of gas, such as that of which our atmosphere is composed. It is the mastery of this same force over the organized aggregate that finally deprives it of its life, and eventually returns the greater part of it to the atmosphere. Evolution, therefore, is in as true a sense the destroyer of life as is dissolution, and it is only by a certain happy combination of the two antagonistic forces that certain aggregates are enabled to maintain, during a very brief period, that highly active, unstable state from which the phenomena of life result. The accident of a gaseous envelope, consisting in great part of nitrogen, combined with a temperature not above nor below the capacities of such aggregates, is the combination of cosmical circumstances to which all life owes its possibility, although it is equally true that, given precisely such conditions, the evolution of living organisms is as much a necessity as their destruction would be were those conditions removed. But we learn from the contemplation of such facts how exceedingly slender is the tenure by which the vital and sentient creation is bound to earth, and how brief the period of its possible existence must be in the history of any planet compared, on the one hand, with the vast antecedent period during which the disintegration of matter is too great, and, on the other hand, with the equally enormous subsequent period during which its integration will have proceeded too far for the support of life. Between these antagonistic forces of evolution and dissolution, as between Scylla and Charybdis, the frail bark of vital existence must pass, while behind lies the illimitable ocean of blank non-existence from which it has been evolved, and before it the certainty of destruction through the slow withdrawal of all the conditions which make life possible (*supra*, p. 164, note).

Unquestionably the most able portion of Herbert Spencer's treatise on biology is his discussion and analysis of the principles of "Equilibration" in Chapters XI and XII of Volume I. It is here that he deals directly with the great problem whose partial solution at the hands of Charles Darwin has thrown the whole scientific world into the very throes of revolution. But, keen as was the insight of this world-renowned naturalist, Mr. Spencer clearly shows that he by no means probed this question to the bottom. The principle which Darwin designated by the term Natural Selection is only one of the chief divisions of the far wider law of Equilibration.

Equilibration is the constant tendency of the organism to adapt itself, by means of morphological and physiological modifications, to the changes going on in the environment. Although the organism must be regarded as a product of the environment, and might hence be supposed to be perfectly correlated with it, still, since there is nothing absolutely fixed in nature, since the environment, even while evolving the organism, is itself changing, and since the process of evolution is always slow and secular, it comes to pass that the correlation is never absolutely complete, and that the forces themselves of evolution are ever tending to modify what they have but just evolved, and demanding that things shall be other than they are in the same name in which they required them to be what they are (vol. i, p. 72; ii, p. 83). Thus arises and ever continues that rhythmic movement throughout the organic world, which can only be adequately designated by the term equilibration.

Equilibration is either direct or indirect.

Direct equilibration is the immediate response of the organism to the demands of the changed environment. The muscle enlarges in response to an increased exercise, the plant bends toward the window from which it receives its light. This, therefore, constitutes the law of modification through use and disuse upon which Lamarck placed so great weight, and which may still be regarded as the primary principle of the doctrine of development.

Indirect equilibration, on the other hand, consists in the transmission to new generations of those variations which are in the direction of the more complete correlation of the organism with the environment. It assumes, to begin with, that every organism possesses at all times a constant tendency to vary in all directions. But for such a susceptibility there could be no equilibration. Were the organism confined to one special direction, in which it could experience modification, it would soon reach a limit of correlation through modifications in the environment to which it could not respond. It is further assumed (or, rather, this is now a fact established by the widest induction) that all organisms are perpetually undergoing slight variations of every conceivable nature, and in every organ, tissue, and part of their organized structure. It is further assumed (and this, too, rests on strong proof *a posteriori*) that every modification of a parent organism is capable of transmission to the progeny of that organism. The same universal law of *heredity* which makes the child resemble the normal parent is that which also makes it resemble the abnormal parent. Now, the law of natural selection, or, as Mr. Spencer more clearly terms it, "survival of the fittest," consists in this: that, of all these minute variations which are constantly taking place in all organisms, only those which tend to increase the correspondence between organism and environment, can be successively transmitted to a sufficient number of generations to cause any considerable alteration in the original stock. Darwin, looking at this process from a practical point of view, saw it in the light of a selection by nature of those modifications which proved of economic advantage to the organism. He, therefore, called it "Natural Selection." Herbert Spencer, regarding it from the stand-point of the physicist, saw it to be only another manifestation of the universal tendency of all the forces of the universe to approach the statical condition. He, therefore, dropped it into its appropriate niche in his cosmical system, and named it "Indirect Equilibration." That it constitutes a mode of equilibration between organism and environment, there can be no doubt. Through it, precisely the same end is accomplished which is reached by direct equilibration, yet the process is very different. The tendency of any part of the organism to respond directly to the immediate demands of a change in the environment is no longer called into account. Only those ever-recurring variations which are proved to be constantly taking place in every part of the individual simultaneously are relied upon for the initial step in the process. But upon all these the forces of its surrounding medium are perpetually reacting in such a manner that only such as prove in entire harmony with it can secure sufficient permanence to admit of being brought under the law of heredity and transmitted to posterity; for, should a variation not in accord with existing conditions succeed in reappearing in the offspring, it would be met on the very threshold of its existence by hostile conditions, and crushed out at its inception. And, in general, all such in-adaptive variations are, as it were, "nipped in the bud," and are never allowed to make themselves manifest in the new generation. But the adaptive variations, meeting no resistance, continue, and re-appear in the offspring according to the law of heredity. Being attuned to the new conditions, they serve to improve the quality of the organism, to lengthen its life, to increase the probabilities of its living to reach the age of fertility and transmitting its improved characters to future generations. So long as this modification continues to accord with its surroundings, so long will this process of re-transmission continue cumulatively to increase, until a new species, or perhaps a new genus, may be at length developed. The amount of modification possible under this law is, therefore, practically unlimited.

Such is indirect equilibration, survival of the fittest, or, as Mr. Darwin prefers, natural selection. It is a mode of equilibration which only finds an appreciable manifestation after a long series of hereditary transmissions, and which operates with secular slowness, yet with unerring precision. The only margin for its operation is in the small advantage which an individual, possessing a slight variation from the general characters of its race, has over its fellows in the struggle for existence, in the slightly increased probability that such an individual, in consequence of this advantage, will live to the age of fertility, and be able to transmit this peculiarity to its offspring. If we contemplate the minuteness of this variation, and take only a single individual into consideration, this increased probability will appear so trivial as to make us doubt whether it could ever be made appreciable; but, if we consider that the liability thus to vary is common to every one of the millions of creatures that usually make up a race, and couple this with the fact that there is no necessary limit to the number of such repeated transmissions, we may readily perceive that any increment, however slight, if multiplied a sufficient number of times, will eventually amount to a marked modification, while the merest tendency to vary, though it fail a hundred times in order to succeed once, will, when belonging to an entire race, result in an immense number of successes, and thus amply account for all the modification which is attributed to indirect equilibration. Those most perfectly equilibrated with their surroundings will, on the whole, and in the long run, live longest, and those which live longest will, on an average, produce the greatest number of offspring. These offspring will, most of them, inherit the peculiarities which gave their parents their advantage; and thus, after a sufficient lapse of time, the number of individuals possessing these peculiarities will become equal to, and at length greater than, the number of those not possessing them.

Moreover, so long as variation in the same direction continues to perfect the correspondence between the organism and the environment, so long the modification in this direction will continue to increase and reduplicate itself, its ratio of increase itself increasing with the increased ratio of the modified to the unmodified individuals, until any observed differentiation may be accounted for with entire satisfaction.

Thus viewed and understood, this fertile law of indirect equilibration becomes extremely reasonable, and its results comparatively simple. Indeed, to those who have made themselves familiar with Darwin's arguments from facts, and Spencer's arguments from logic, the conviction of the real truth of this principle usually becomes complete.

Mr. Spencer admits that the influence of natural selection is very great, but thinks that Darwin gives it a somewhat undue importance. Lamarck failed to grasp this principle,* and attributed all organic modification to the inherited results of use and disuse—*i. e.*, to direct equilibration. Darwin almost wholly neglects this, and relies chiefly upon the new and brilliant conception of natural selection. Spencer gives to each its proper weight, and, what is chiefly to his credit, assigns to both their exact place in the system of laws pertaining to vital phenomena.

Of the second volume of the "Principles of Biology" we can here say very little, since any attempt to review this part of the work would necessarily carry us far beyond the limits prescribed for its consideration. It may, however, be remarked in general terms that it consists of a systematic effort to establish, *a posteriori*, from a multitude of appropriate illustrations, both in the department of morphology and in that of physiology, the several general principles arrived at deductively in the first volume.

The primary truth which it is here sought to establish inductively is the universality of the operation of the law of evolution throughout the domain of organic life. Of this law, the most obvious manifestation is the evidence avail-

* Quite distinct adumbrations of the law of natural selection may, however, be found in the first volume of the "Philosophie Zoologique," pp. 112–114, 259, 265.

able to demonstrate that organic forms are the outcome of the forces in operation in the environment in which each organism exists. The amount and cogency of this species of evidence, as marshaled here in this work, are not only surprising but convincing, while the manner in which it is presented by Mr. Spencer is that best calculated to make its force felt and its relation to the general argument appreciated.

It would, perhaps, be almost an injustice to Mr. Spencer, notwithstanding our necessary inability to enter into details, not to call somewhat more special attention to a single instance in which he, through the logical pursuit of a great principle, has developed a minor but important truth, whose enunciation and proof have won for him the highest encomiums from the leading specialists of the world. I refer to his celebrated and now generally accepted theory of the mode of development of the *Annulosa*. All animals above the simple cell are composed of some combination of several cells. Taking the cell as the unit of individuality, the greater number of creatures may be regarded as individuals of the second order. But an examination of the annelids shows a remarkable peculiarity in this group of animals. They are all composed of numerous rings or annular segments, known as "somites," which are attached to one another, forming a longitudinal series, and upon the number of which depends the length of the animal. A close inspection of these somites reveals the fact that each is provided with numerous distinct and independent organs, some of which are in full operation, while others are more or less rudimentary. Each has its independent locomotive appendages, where the creature possesses any, and these are in constant use at the command of the general system. But, besides these, there are sometimes eyes in each segment. The repetition of internal organs is still more apparent. "Each has its enlargement of the alimentary canal; each its contractile dilatation of the great blood-vessel; each its portion of the double nervous cord, with ganglia, when these exist; each its branches from the nervous and vascular trunks, answering to those of its neighbors; each its similarly answering set of muscles; each its pair of openings through the body-wall; and so on throughout, even to the organs of reproduction." Not only is this true, but a study of the life-histories (*ontogenesis*) of this group shows that this segmentation takes place successively by the addition of new segments to a primordial germ of the first order. This occurs chiefly within the egg, but in two entire orders, the *Dorsibranchiata* and the *Tubicolæ*, the embryo leaves the egg in this simple condition. Moreover, there are some of these creatures, as the common tape-worm, in which each segment is so far distinct from the rest that it will live when separated and will put forth new segments. It is thus clear that the annelids are simply compound animals—*i. e.*, animals of the third order—and that each somite must be regarded as a complete animal of the second order.

But Mr. Spencer does not stop here. He proceeds to point out in the most convincing manner that this state of things grew out of the actual relations which these creatures sustain to their environment, that the forces of adaptation and natural selection have operated to bring it about, and that these forms are but the final product of equilibration according to the general laws of evolution. Indeed, this particular and, from this point of view, exceedingly interesting group of animals is only one of the many illustrations which he presents of the general truth which should be ascribed to him, that throughout the organic world, both among animals and among plants, and in the vertebrate sub-kingdom as well as in the invertebrate series, there is every-where a striking conformity in the shape of the organism to the conditions under which it exists and the circumstances out of which it has been evolved. All the facts of phylogeny and of ontogeny, of geographical distribution and of anatomical symmetry, of morphology and of physiology, conspire to confirm this universal law, whose first systematic presentation is to be found in the "Principles of Biology."

The work closes with an interesting treatise on the laws of multiplication, in which the general theory of human population is appropriately discussed. He here extends the law of the antagonism between nutrition and reproduction to the human race, and maintains the general truth that, with certain limitations, fertility and development are inversely proportional. As man, therefore, continues to develop, his degree of fertility will correspondingly decline, until multiplication will eventually cease, and a stationary population of the world will be reached.

With this brief and very unsatisfactory survey we must here close the consideration of Mr. Spencer's truly great work on the "Principles of Biology," a work which will be still replete with fresh truths and profound suggestions after the science of biology shall have become as firmly established as many of its sister sciences are now. Different critics, viewing Mr. Spencer's works from different points of view, will naturally differ in their verdict upon their relative merits. But, considering the state of the science when this treatise was written, and the fact that Mr. Spencer does not profess to be a naturalist, it must be admitted that the "Principles of Biology" is a true masterpiece. Precisely what this science needed, ridden as it had so long been by narrow specialists and inflexible systematists, was a broad and enlightened survey of its field, and a philosophic synthesis of its principles. This is pre-eminently the service performed in this work, and for this the "Principles of Biology" is deserving of the highest commendation.

The "Principles of Psychology" has been by many regarded as Mr. Spencer's greatest work, and that upon which his reputation as a philosopher will finally rest. It creates an entirely new departure from all that had previously been thought to constitute the philosophy of the mind. Without going to the extreme lengths of Gall and Spurzheim in seeking to establish a purely physiological science of mind before the nature of the brain and nervous system were at all understood in their relation to function, Mr. Spencer has, nevertheless, sought to demonstrate that all the phenomena of the mind have this physiological basis.

Mind consists essentially of two elements, feelings and the relations between feelings. Feelings are the result of the passage of nerve-currents through the various parts of the system. These may originate either externally or internally. Those originating externally are in the nature of sensations; those originating internally are known as emotions. A nerve-current is set up by the contact of any part with an external object. This current is carried from the part affected to the nearest nerve-center or ganglion. From this it may be communicated to higher and more remote nerve-centers, or it may go no farther, depending on the nature of the organism and on that of the contact. The nerves that convey impressions from external surfaces to internal nerve-centers are called afferent or sensor nerves. Corresponding to these there proceed other nerves, so co-ordinated as to convey back to the point of contact an impulse to perform whatever action may be required by the nature of the impression. These are known as efferent or motor nerves. The state of mind produced by the contact of a foreign body is called a sensation. In a highly organized being like man every new sensation is carried up to the highest co-ordinating nerve-center, the brain. If consciousness is to be distinguished at all from sensation, it consists in the cognizance which this highest nerve-center takes of the impression. In one sense every nerve-center may be considered as a distinct individual, having a consciousness of its own. In the lowest organisms, in which there exists but one nerve-center, the distinction between sensation and consciousness disappears. Here every action is what is called a *reflex action*. The impression passes to the ganglion on the afferent nerve, and is returned in the form of motion along the motor nerve. The whole is strictly consensual—automatic. Between this and complete consciousness there are all stages, according to the degree of generality of the highest ganglion to which the sensation attains. Unconscious and habitual actions arise from the gradual reduction of the number of nerve-centers to which the muscular impressions are conveyed. By long habituation they become purely reflex.

Perception is the act of arriving at the nature of the object by means of its impression on the subject. It is the correlate of sensation. Yet it is by no means simple, but consists in a comparison of sensations. If a first sensation could be conceived of, it could have no corresponding perception. The subject could form no idea of the object. It is, therefore, a comparison of a given sensation with previous and simultaneous sensations by which a judgment can be formed of the nature of the object. In short, perception is a relation between feelings. It is, therefore, the initial process of mental operation. All higher acts of the intellect are further compoundings of this with other relations between sensations.

The fundamental distinction between intellect and sensibility, between the rational and the sensual departments of mind, is resolved into the distinction between sensation and perception, between feeling itself and the relation between feelings. As every nerve consists, not of a single fiber, but of a bundle of fibers, it becomes possible for a single sensation to give rise to a perception consisting in a comparison of the different feelings produced by the different fibers of a single nerve. By this means, and by multiplied repetitions of kindred sensations, such comparisons lead to a proximate determination of the nature of the external objects producing these sensations. It is thus that the greater part of our knowledge is made up, and it is this process which is known as experience. Not that our conceptions of objects, derived from a co-ordination of repeated perceptions, enable us to know what external objects really are, or how they actually resemble and differ from one another. They only teach us what qualities they possess, and in what manner they are capable of manifesting themselves to the senses. The true proof of their real existence lies not in the sensations they produce nor in the perceptions derived from those sensations. This proof lies in the *persistence* of these sensations and perceptions. Whatever persists exists, is Mr. Spencer's dictum. The same object often persists during the entire life of an individual, and even of many generations of individuals, and produces every day the same sensation from which the same perceptions follow, and the same conceptions are necessarily formed. All the objects which constitute the surroundings of every individual persist in a nearly unchanged relation and mutual configuration. Were they unreal or purely subjective, the chances are infinity to one that this could not be the case. If the reality of the *non-ego* is susceptible of proof, that proof is to be found in its persistence in consciousness.

All our feelings present themselves in two series—a vivid series and a faint series. The vivid series is produced by the actual impression made by an external object upon a given nerve or set of nerves. In conveying its vibrations along the nerves to the nerve-centers, an actual change is effected in the structure of the nerve-tissues. Not only does a current of vibratory waves traverse the nerve, excite the ganglia, and produce a real movement among the molecules of the brain, but, after this immediate effect has ceased, the nervous system is left in an altered condition, which may continue for days or years or through life. A new consciousness of this precise condition may be induced an indefinite number of times by the recurrence of such circumstances as are required to recall it. These renewals of past states of consciousness are less vivid than the original states were. They constitute the faint series, and the faculty by which they are produced is equivalent to what is known as *memory*.

The lowest mental state is that which results in reflex action. This is not confined to the lowest animals, but is found to occur in the young of all animals, including man, and there are some actions that adults perform which can with difficulty be classed under any other head. These actions approach most closely to those observed in purely physical phenomena. A change in the environment brings an external object into direct contact with a bundle of nerve-fibers. A current is at once set up in the nerve, which passes directly to the ganglion, and is there discharged through a motor nerve, resulting in the motion corresponding to the impression. The resultant action in the lower animals always concerns the preservation of life. It is the necessary action either for escaping danger or for securing nourishment. As low forms gradually become more highly organized, the movements necessary to secure these ends become more complicated and different in character, but this change never occurs too rapidly for corresponding changes in the nervous system to keep exact pace with them, until at length we see quite highly organized creatures performing very complicated actions with all the apparent precision of reflex actions. Such actions are called *instinctive.* Instinct is, therefore, simply "compound reflex action." But, as reflex action is only the result of an exact correspondence brought about by a long period of development between the organism and the environment, between the objects that surround an animal and the nerve-tissues within its system, so this same result may be produced by the repetition of a somewhat complicated action in the most highly developed organisms. By such frequent repetitions, *habits* are formed by men which often approach very closely, and even reach, the strictly automatic. After each repetition of the same action, consciousness begins more and more obviously to lose its hold upon the lower nerve-centers, the nerves immediately employed in performing the action, and the muscles brought into play by its performance, until it finally ceases any longer to co-ordinate this particular class of action, which becomes purely habitual or automatic. The actions of the various so-called involuntary and semi-involuntary muscles, such as produce the heart's pulsations and the respiratory movements, must, undoubtedly, be explained on this principle. The distinction between instinct and habit, therefore, is very slight. It consists more in the manner in which they are respectively evolved than in any true qualitative difference. Instinct may be called a *phylogenetic*, habit an *ontogenetic* process.

Just as certain actions become reflex, automatic, instinctive, and habitual, so certain states of mind come at length to follow one another with ease and regularity. Indeed, the greater part of our daily thoughts are such as perpetually cohere in consciousness, and can only be separated with greater or less degrees of difficulty. And as among animals the lower they stand in the scale of development the more regular their actions become, so states of mind are found to cohere more completely in less developed than in more developed creatures; and of men the lowest races and the most imperfectly organized individuals present a greater uniformity and fixity of ideas than the highest races and the most perfectly organized individuals. The highest types of mind are perpetually making excursions into new fields; old fields are traversed at different angles and in different ways from those in which ordinary minds traverse them; original thought takes the place of traditional belief; old truths are placed in new lights, and compared with other truths with which ordinary minds do not compare them; and thus the path of consciousness is almost always new and the coherence of its states is very slight. As the automatic becomes thus insensibly transformed into the original, the coherent into the disjunctive, the frequent into the unfrequent, the mental process passes from the instinctive into the *rational.*

Reason consists in the intellectual establishment of new and original relations. The ability to do this is the test of intellectual power. It is the originality of a mental adjustment, and not its adaptation to a particular purpose, which indicates intellectual development. The purpose may be subserved through countless generations of adaptive modification in very lowly organized beings, as insects, or it may be reached by a single original effort of a highly developed brain, as in man. The one is instinct, the other reason.

Such is, in its barest outlines, Mr. Spencer's synthesis of mind, from which it is clear that he regards the psychical faculty as one fact, presenting many degrees from the lowest creatures to the most enlightened human beings, and that psychological phenomena are as dependent upon the environment as are those of life.

Turning to the analysis of mental phenomena and laws, as Mr. Spencer has set it forth in the second volume of the "Principles of Psychology," we need not be surprised to find that he differs from most logicians in his ideas of the nature of the reasoning process. If reason is simply the power to combine relations which neither experience nor heredity has made coherent in consciousness, then clearly the mode of performing this operation is not likely to resemble closely any of the intellectual operations which logicians have described as constituting the reasoning process. Every essential step in the operation he calls an "intuition." The reasoning power is a power of direct comparison of relations not before compared, or not compared often enough to produce cohesion in consciousness. This act of original comparison is a pure intuition. All relations capable of comparison are either of degree or of kind. The faculty of comparing them is, therefore, either quantitative or qualitative. Quantitative reasoning compares relations which differ, if at all, only in degree, and its greatest completeness exists when this difference disappears entirely and equality is reached. Quantitative relations are either equal or unequal. Qualitative reasoning compares relations which differ, if at all, in kind. In order to be comparable, they must have a certain degree of resemblance. They must be in some measure alike. As quantitative reasoning is founded on the notion of equality, so qualitative reasoning is founded on the notion of similarity. Mr. Spencer, however, fails to perceive, or at least to state, that these two may be reduced to one; that qualitative relations may be referred to quantitative ones by taking them in part only; and that, to say that two relations are similar, is equivalent to saying that parts of them are equal.

In the reasoning from generals to particulars, which is very common in every-day life, the process is usually what is called reasoning by analogy. The accuracy of conclusions reached by this kind of imperfect qualitative reasoning depends in great part upon the ratio between the number of known to the number of unknown relations or attributes. Where the number of known attributes is very small, and the number of unknown very large, we have that fallacious species of analogical reasoning that underlies all sophistry, and much past and current superstition. When a respectable number of attributes becomes known, the reasoning becomes inductive. A particular attribute is inferred from a large number of known like attributes, although the number still unknown may greatly exceed the number known. As the ratio of the known to the unknown diminishes, the force of the induction increases until the point of equality is passed, after which, according to Spencer, the reasoning becomes deductive; or, to use his own words: "If the known relations, grouped together as of the same kind, outnumber the unknown relations conceived to be like them, the reasoning is deductive; if the reverse, it is inductive."

While this may be accepted as the best definition of deductive reasoning, it is not the current acceptation of the term.

Reasoning is distinguished from logic in being a subjective process rather than an objective science. An account of the former would describe the mental operations gone through with in the act of forming intuitions from a comparison of relations. Logic, on the contrary, is the science of those relations in themselves, objectively considered. The syllogism Mr. Spencer regards as an aid to the science of logic rather than to the act of reasoning.

Psychical phenomena being, like vital phenomena, the result of prolonged and continuous intercourse between the subject and the object, which are always in correspondence, it follows that the fundamental relation is the relation of subject to object. But the manifold character of the external world gives rise to various manifestations of this relation, all of which may be reduced to that of resistance as the generic form of all relations perceptible to the mind. The reality of the object is proved by the persistence of the different relations.* While its nature is unknown, and can have no resemblance to the conceptions produced by it in the mind, its reality is none the less demonstrated as positively as that of the relations themselves. With regard to the nature of the object, however, Mr. Spencer has put forward a most ingenious theory under the name of "transfigured realism," which is worthy of the palmiest days of transcendental speculation. The mind is represented as a receptive surface of peculiar shape, *e. g.*, a cylinder. External objects are assumed to cast their impressions upon this receptive surface as shadows are cast upon a wall. The images thus produced are, as it were, in perspective. As the shadow of a cube upon a cylinder would have a shape entirely different from a cube, so the images of things projected upon the mind can have no necessary resemblance to the things themselves. Yet as certainly as a shadow proves the existence of an opaque object between the surface on which it falls and the source of light, so certainly do the conceptions of the mind demon-

* This principle consitutes the basis of the rule in science which requires all truth to be verified, and accepts only what has been verified. Verification is simply the process of testing persistence. (See vol. ii, p. 417.)

strate the reality of that transcendental substance without which no conceptions could be formed.

In summing up our general estimate of the "Principles of Psychology," we are obliged to admit that, if it were Mr. Spencer's only production, it would go far toward making an epoch. At the same time we fail to discover any evidence, either internal or external, which is sufficient, from our own point of view, to assign to this work a rank superior to that of the "Principles of Biology."

The "Principles of Sociology" have now (1882) advanced to near the conclusion of the second volume. Volume I has regularly appeared, and the first division of Volume II has been published separately. The magazines contain the later chapters. We will glance at Volume I.

Doubtless many were disappointed in this work. It is certainly a very different book from what its title would lead any one unacquainted with Mr. Spencer's other works to expect. The term society and the notion of social phenomena rarely give rise in the ordinary mind to any other ideas than such as are associated with advanced societies. The thought of going back to primitive man seldom occurs. A work on social philosophy is supposed to treat of the laws which govern industry, domestic relations, religious observances, social customs, the way in which men co-operate in business, carry on their commercial and manufacturing interests, dress, build houses—in short, the way men live. And if an historical view is taken, it is expected to compare the life of the Greeks and Romans, of the Chinese, Turks, etc., with that of modern civilized peoples. To go back of recorded history is deemed speculative and Utopian, and the thought seems scarcely to have struck any body that existing non-historic races may be regarded as living representatives of the prehistoric ancestors of existing civilized races. The study of society from the standpoint of evolution, admitting the evolution of society as well as of the rest of nature, is therefore a new departure, and the starting-point from primitive man in his pre-social state seems to many a strange way of looking at social questions.

Another thing which seems somewhat singular is that he should regard *ideas* as the principal *data* of sociology. We are here reminded of the method which he adopted in writing his "First Principles." The object aimed at in his "Unknowable" was to assign to faith and religion their proper share of thought and of things. This he deemed necessary in order to lay out the field of his future labors. The conclusion which he reached was that to religion belongs all that can not be known. In the great struggle of human ideas to solve all the problems presented by nature and by mind, many had been proposed that are in the nature of things insolvable. These are the materials and the objects of faith. The progress of human ideas has ever been in the direction of drawing the line between the Unknowable and the Knowable, and the conflict between religion and science has been due to the perpetual encroachments of each upon the domain of the other. Human thought has been a constant effort to know, and irresolvable questions have as frequently forced themselves upon it as those of the opposite class. In the beginnings of thought, therefore, the Knowable and the Unknowable were completely confounded. Religion and science were not as yet differentiated. In the prevalence of ignorance all ideas partook of the nature of religious ideas. Every conception rested on faith, *i. e.*, on some form of belief. The scientific ideas of causation, of rational explanation, etc., were wholly wanting. The primitive man judges everything after himself. His narrow range of experience only teaches him that he can produce mechanical effects, and any manifestation of such effects in objects outside of himself is naturally attributed to a like power in such objects. Mr. Spencer had before shown that social phenomena rest fundamentally on psychic phenomena. Society is not alone an aggregate of individuals. It is an aggregate of individuals possessing ideas. Ideas are, therefore, the fundamental facts of sociology. But, if the genesis of society is to be worked out, the progress of ideas must be studied, beginning as low down as the knowledge of the age will permit. And, if primordial ideas are to be studied at all, they must be studied as they are, and as all the evidences show they must have always been. The attempt to ascertain what primitive man thought about political economy, social order, domestic relations, moral law, or religious truth, would be simply absurd, since primitive man never thought any thing about any of these things. These are advanced ideas, derivative conceptions, modern forms of thought. And yet, the primitive man thinks. He thinks vigorously within the narrow range of his experience. Those who have carefully followed Mr. Spencer through Part I can but be convinced of this truth when they consider the great system of ideas which savages have built up, consistent in all its parts, and strictly logical in all its conclusions, if only the premises had been sound. And, if they have gone far astray, if the entire edifice is after all only a "monstrous farrago," * they have not done so much worse than certain metaphysicians who have flourished in the most enlightened countries and ages of the world.

Although the expression "data of sociology" may not be the proper one to comprehend an enumeration of the principal ideas of primitive man, still it can not be denied that such an enumeration constitutes an important "internal factor" in the solution of all the chief problems which sociology presents.

From what has already been said, it appears clear that the study of the ideas of primitive man is nearly the same thing as the study of the genesis and history of religion among men. It was only at a later and historic period that philosophic speculation became differentiated from religious speculation, and only in comparatively recent times have

* E. B. Tylor, "Primitive Culture," London, 1871, p. 120.

scientific ideas had any part in the general current of human thought. This differentiation is, moreover, far from completed in the most advanced nations, and the strict confinement of religious ideas to the absolutely unknowable can never be realized so long as there remains the least room for dispute about the boundaries of this realm. Comte's generalization, therefore, that the lowest forms of religion are most intensely religious, is true in the sense that the lowest ideas are nearly unmixed religious ideas.

One of the greatest demands of the age has long been a genesis of religion. We have had ecclesiastical histories, labored attempts to show the workings of religious systems in different ages, nations, and races, and lastly some praiseworthy efforts to subject existing systems to rational analysis and unbiased historical criticism. But these have, after all, added little to our real knowledge of what religion is, and why it is so universal. The philosopher has long observed that in proportion as knowledge, science, and intelligence spread among men, the strong religious spirit disappears. Some have argued that this tendency must eventually eradicate the religious sentiment from mankind, since already many of the truly greatest and best men have nearly or quite wholly renounced all attachment for, or belief in, any religious system. This idea was fast gaining acceptance until Mr. Spencer came forward with his famous "reconciliation," which showed that there is a limit at which this differentiation must stop, while the apparently innate sentiment of worship will ever possess an object in the Absolute, the Unconditioned, the Unknowable.

But this service, great as many think it to be, is small compared with that which he has rendered in the first part of his "Sociology." We have here at last a key to the fundamental problem, How has religion been introduced into the world? We now have a rational *explanation* of religion, its origin and cause as a cosmical phenomenon (vol. ii, pp. 252 *et seq.*). If man has really descended from a condition psychically on a level with the lower animals, as many anatomical as well as ethnological facts indicate, then there must have been a beginning to religion. No animal race gives evidence of the possession of a religious sentiment, and, if man has once been an animal, this sentiment must have originated somewhere in the course of his development from animality to humanity. But even for those who reject this view there are facts showing that religion, like many other highly developed sentiments and institutions, has been a growth. There are a few races that can scarcely be said to possess any such sentiment, and that have none of the symbols or rites which universally attend it. The existence of a religious sentiment presupposes ideas, and there are races that can scarcely be said to have any ideas. Religion is the product of thought. It develops after a long course of reasoning about the facts of experience. It is the outcome of a real philosophy. It results from the natural struggle of the mind to know. In any age or race the materials of religious belief are unexplained phenomena. The true domain of religion is the unknown. It will continue to be so even after that domain is narrowed down to synonymy with the unknowable. And, as already said, during this entire period in which the boundaries of the unknown are being contracted, there will necessarily be conflict.

Reduced to its lowest terms, belief is the presumed explanation of phenomena. The sum of all the beliefs of any people constitutes their theory of the universe. This is true, however narrow or wide their view may be. The theories of modern scientists only differ from those of savages in the higher credibility of the experiences on which they rest. They are simply greater approximations to the truth universally sought to be reached. Science itself only differs from religion in the degrees of certainty attainable in human knowledge. We believe in the heliocentric rather than in the geocentric theory, because we regard the evidence as possessing superior credibility. We believe in evolution rather than in special creation, for the same reason. And thus it is throughout. All depends upon the degree of verification, and upon the susceptibility of the mind to the influence of rational proof.

The religion and the philosophy of the savage are one. All his ideas are religious ideas. Before he has religious ideas he has no ideas, and is in the condition of an animal. Animals, it is true, think, but it is always about some immediate object to be attained. Their ideas, if they are entitled to be called such, are of the *conative* class, never abstract. They never seek the explanation of phenomena for its own sake. This is, perhaps, as good a line as can be drawn between the human and the animal mind. Nor should we forget that such a line would consign a large part of mankind to the animal class. For it is, after all, only the few who really think. Not every savage could build up a cosmology or a religion. A few elaborate the principal beliefs and the mass accept them at second hand. This is as true of the lowest as of the highest races. Mr. Spencer, no doubt, would admit this, but he has unfortunately failed to formulate it, and thus left some parts of his admirable scheme open to criticism.

Abundance of facts conspire to prove that primitive ideas have all emanated from the individual's experience of his own powers. The most fundamental of all such experiences are those connected with personal locomotion. The savage's idea of life is ability to move. Whatever moves is supposed to do as he does when he moves. It therefore must be constituted, in that one respect at least, as he is constituted. Hence, one of the first results of human reasoning is the attributing of life to inanimate objects. This process resulted in some of the forms of fetichism. But it also led to other consequences, which we shall presently consider.

Akin to this conception was that of the presumed power of metamorphosis which a certain class of phenomena early led primitive man to ascribe to almost every object in nature. Among these Mr. Spencer enumerates the formation and dissipation of clouds, the succession of daylight and darkness, the appearance and disappearance of the sun, moon, and stars, the phenomena presented by comets, meteors, lightning, the aurora, the rainbow, etc. One of the most remarkable facts which nature ever presses upon the attention of the primitive man is that of *wind.* It is the very embodiment of power without visible cause. The savage never thinks of the air as a material substance. There are doubtless people in the most civilized countries who never so conceive it. And yet consider the wonderful effects daily produced by this mysterious invisible agent!

The general sum of all these phenomena must have produced some impression upon the minds of primitive men, and the study of the ideas prevailing among existing savage races shows how profound this influence has been.

Amid the many collateral ideas to which these phenomena give rise, there is one central one which takes more and more definite shape as the mind strengthens and the power of drawing conclusions increases. This idea is that of the transmutability of all things, and particularly the power of every object in nature to assume at will a visible or an invisible form. This belief in unlimited metamorphosis is strengthened by a thousand minor details which everywhere present themselves whenever the savage attempts to study or observe the most familiar facts of his experience.

The growth and decay of vegetation; the transitions from eggs to young birds, and from these to full-plumaged ones; the true metamorphoses of insects (which must have escaped the observation of all but a very few); the resemblance of fossil shells to living mollusks (a still more obscure fact); the resemblance of certain beetles, butterflies, etc., to the twigs, leaves, and bark, which natural selection has caused them to imitate—all these and endless other phenomena are ever recurring to strengthen and confirm the notion once conceived that every object in the world possesses the power to transform itself into any shape, color, or condition that may satisfy its caprice.

These phenomena are external or objective, but there is a corresponding class of internal or subjective phenomena. There are all these evidences that external objects possess numerous distinct forms, which they assume at different times, and there is an allied body of evidence that man himself has also a number of forms into which he often passes. Such evidence is afforded by dreams, by various pathological states, such as swoons, catalepsy, delirium, insanity, apoplexy, and even by death. It is also based on at least three forms of external proof which carry with them the additional idea that difference of time is not requisite for these transformations: these are the phenomena of echoes, of shadows, and of reflected images. The savage never doubts that an echo is a real voice, never conceives it possible that the shadow of himself which he sees on the ground in sunshine has no material reality. He thinks them the voice and the figure, respectively, of his other self. Still more conclusive is the image he perceives in the water. His friends inform him that this image exactly resembles him to the minutest feature of his countenance, and he is able to verify this by comparing the reflections of others with the originals. Surely these images are real persons, and every person and every thing can thus be proved to have at least two doubles, the shadow and the reflected image. The primitive man reasons in the same way about dreams. He never doubts for a moment that he has actually experienced what he has dreamed. And yet, on awaking, all the evidences, including the testimony of others whom he can trust, prove that his body has not been absent. This difficulty, however, does not trouble him. He believes that it is his double that has experienced the things dreamed. The case of swooning, in which the person may live for days in a state of lethargy, and finally come to himself and recount a long series of strange events experienced while in that state, only shows that the double has the power of remaining away from the body for an indefinite period. The phenomena of catalepsy and apoplexy still further confirm this belief, and finally death itself comes to be interpreted as an unwillingness or inability on the part of the double to return at all. The question then naturally comes up, "Where has the double gone?" It has left the body of a man and has doubtless gone somewhere. In sleep it had been in the habit of wandering about, hunting in strange lands, or fighting hostile tribes. Now it has gone for good, but where? Upon the varying answers given to this question will depend the multitudinous customs of different races respecting the disposal of the body, and the character of their beliefs in a future existence and a future world. But among all these varied beliefs there is one common to all races which have acquired any degree of reasoning power; that is, the belief in some kind of a future life and in some place of future abode. Here we have a complete genesis of this universal belief, and a satisfactory explanation of its universality. It ends the war between the religionists and the anti-religionists, the former of whom claimed that the belief in a future life was universal, and must, therefore, be an innate sentiment, and the latter of whom replied that its universality had not been proved. The premises of the first are practically sustained, but in such a way as to disprove their conclusion, while the claim of the latter is opposed to the facts. The simple truth comes forth that the universal belief in another life after death is a necessary conclusion which must be drawn by the primitive man, as soon as he begins to reason, from the phenomena which nature always presents. The universality of the belief in an after life is due to the simple fact that from identical phenomena reason, which is not a thing of race, will uniformly deduce an identical conclusion. There is immense variety in the minor accompaniments of this general belief, but the central idea itself is found almost every-where.

The savage's philosophy does not, however, stop with the conception of a future existence and a separable double—a persistent self, independent of the body. It proceeds still further to elaborate the system of primitive ideas. The spirit, or persistent self, is usually supposed to remain near the place where the dead man lived. It is commonly believed to haunt the locality where the body was finally placed. It lingers round the corpse as long as it remains preserved, and follows it into the cave or mountain or stream or tomb. An endless variety of ceremonies is found to exist, which have grown out of these beliefs, and which control the funeral rites of different tribes. Among the most important and instructive of these are the various modes of preserving the dead body, some of which reached so high a perfection of art that the mummies of Egypt and Peru have survived during a period of two thousand years.

The idea of the survival of individuals that die could not help exerting a profound influence upon the living. In the first place, conceiving, as savages usually do, that the persistent ghost remains near the scene of its career during life, or at least frequently returns to visit it, the effect is to people every spot with innumerable spirits. These spirits are very generally regarded as evil-disposed, and to them are attributed all the misfortunes that befall the living. This, too, furnishes an explanation, satisfactory to the savage's mind, of all the mysterious phenomena of nature. Incapable of conceiving the operation of natural forces, he had from the first accounted for all movements in the inanimate world on the principle of indwelling spirits, and now with the vast accumulating host of liberated human doubles there is no lack of materials for animating every object in nature. And this, Mr. Spencer thinks, is the true theory of fetichism. The beings that animate the sticks and stones are the ghosts of deceased men and women.

A still more important consequence of this belief is that which follows on the death of any great chieftain or mighty ruler. The souls of such men, too, persist. They, too, linger round the places of their glorious achievements, and are the invisible spectators of every act performed by their subjects and their descendants. What must be the effect of such a belief? For a while, elaborate ceremonies are performed over the tomb of the dead hero. His weapons are usually buried by his side, to fight with in the next life. Vast treasures, too, are frequently placed in his grave, to be used hereafter. Too often slaves and attendants and even wives are sacrificed, to accompany him and minister to his wants. As time goes by, his earthly exploits are more and more exaggerated. None but the most wonderful accounts are remembered, and these receive fresh accretions of marvelousness at each repetition. Complete apotheosis is the ultimate result. At first he was the son of a god, and finally he never was other than a god. And, having been a god and still existing, he is still a god. But apotheosis is a gradual process. There is no line between a hero and a god. Worship began long before divinity was reached. The first form of worship was this *ancestor-worship*. The first gods were ancestral heroes. Gods, one and all, are neither more nor less than transformed men. The idea of independent deities is shown to be a comparatively advanced and recent development. Ancestor-worship is not only almost or quite universal among savage and barbarous tribes, but it is traced to both the early Semitic and the early Aryan civilizations. In ancestor-worship we have the nucleus of all subsequent forms of religious belief. In the belief in a persistent ghost we have the groundwork of all religious superstitions. Fetichism is the peopling of particular objects with these ghosts. Idolatry is the artificial manufacture of an object for them to occupy. Metempsychosis is the transmigration of these souls into inferior animals.

Animal-worship grows out of the respect shown to those animals into which ancestral heroes are supposed to have passed. Another explanation of animal-worship is, however, proposed, which makes it a direct consequence of ancestor-worship. It is well known that very many tribes name their children from some accidental circumstance occurring at or near the time of their birth. Most commonly they receive the name of some object that may strike their parents in a special manner. Such objects are frequently animals, as it is with these that savages more especially deal. Hence their children bear the names dog, bear, wolf, horse, bull, lion, tiger, eagle, etc. Not unfrequently powerful chiefs are thus named, and after their death are raised to heroes and then to gods. They are thus worshiped under their animal names, and are made the founders of new tribes. These tribes, at first recognizing their descent from a great ancestor called the Bear, the Stork, or the Serpent, finally lose sight of his ancestral, and indeed of his human, character, and, remembering his *name* only, confound it with the real animal with which they are familiar. They thus come firmly to believe that they are the real descendants of these animals, and they prove the sincerity of this belief by holding their supposed ancestors sacred and even worshiping them with great ceremony.

Plant-worship no less than animal-worship is explained on the ghost-theory, and is hence a derivative form of ancestor-worship. First, plants furnishing artificial stimulants, such as the "soma," the vine, etc., become objects of worship in consequence of the physical exaltation which they furnish. But this effect is attributed to an indwelling spirit which animates the plant, and through it exerts this peculiar influence over men. This spirit is the double of some great ancestor, whose powers during life are only exceeded by his powers after death.

Again, tribes that have migrated from a forest retain an ever-fading tradition of such an emergence. The imperfection of their languages and the laxity of all their conceptions lead eventually to the confusion of the idea of having come out of a wood with that of having descended from a wood. The idea once started that they were the descendants of a certain grove, or tree, or kind of reed, would be readily believed on account of its strangeness, and the whole tribe would soon come to regard these objects as their true ancestors, and would worship them accordingly.

Lastly, the naming of children after plants leads to the same result precisely as does the naming of children after animals.

The worship of other kinds of natural objects is accounted for on similar grounds, and facts are not wanting in support of such explanation. Even star-worship and sun-worship, which have formed the highest types of worship below that of ideal deities, admit of similar derivation from ancestor-worship. In the words of Mr. Spencer, "partly by confounding the parentage of the race with a conspicuous object marking the natal region of the race, partly by literal interpretation of birth-names, and partly by literal interpretation of names given in eulogy, there have been produced beliefs in descent from Mountains, from the Sea, from the Dawn, from animals which have become constellations, and from persons once on Earth who now appear as Moon and Sun."

The origin of deities is thus made clear. The apotheosized ancestor soon loses his connection with earth and becomes a god. Grecian and Roman mythology furnish us with all the degrees of this progress from the simple man to the hero, and from the hero to the deity. The mythologies of other advanced nations show the same. Polytheism comes first, as various mighty names become successively raised to the divine state. Integration early sets in, and a subordinated hierarchy results. Little by little the highest deity acquires supremacy, until at length the rest of the pantheon is swallowed up in him. The principal forms of so-called monotheism have retained innumerable lesser gods in the persons of angels who are deified saints, while most of them have recognized a distinct dualism, in which the powers of the malevolent deity have compared so favorably with those of the benevolent one that the term monotheism becomes quite inapplicable. Hebrew monotheism is nearly pure,* and has been best preserved by the Mohammedan sect. Mr. Spencer, however, cites passages from the Hebrew Bible in which the ancestral origin of Jehovah is sufficiently clear. Thus is every form of human worship and human religion referable to the universal custom of venerating the dead.

The theory here sketched, and which is elaborated with great care and skill by Mr. Spencer, is remarkable in a number of respects. In the first place, it is the first attempt ever made to trace the real history of religion to its original source in the phenomena of nature and the laws of thought. If true, it constitutes the genesis of religion, and explains all the most difficult facts connected with its existence and diffusion among men. In the second place, this effort is remarkable from the manner of its presentation. It is no mere theory elaborated out of the web of logic in the author's brain. In every particular he has allowed himself to drift with the current of accumulating facts. The great bulk of the volume is made up of citations of simple facts as gathered together from every available source.

The time seemed ripe for this great undertaking. For twenty years the materials for it have been accumulating, and the world had already been treated to several able presentations of the general subject. Those who were familiar with the recent great works of Sir John Lubbock and Mr. E. B. Tylor felt that we were on the eve of some grand revelation respecting the origin of our civilization and of our race. Not only has Mr. Spencer drawn freely from these and other rich sources, but to them he has by his own efforts, in his "Descriptive Sociology," added a new and bounteous supply,

* Recent critical studies of the text of the Pentateuch have made it tolerably certain that in Moses' time at least a form of polytheism prevailed, of which the plural form *Elohim*, which monotheistic translators have taken the liberty to make singular, affords the strongest *prima facie* proof.

from the combined currents of all of which streams he has poured a vast flood of light and truth upon the world.

Finally, the manner in which the facts have been marshaled by Mr. Spencer would in itself constitute a new departure. For the first time the bearing of this class of facts upon the law of evolution has been recognized and distinctly pointed out. Not only worlds, and plants, and animals, and society, but ideas themselves have been evolved according to the same universal laws. The phenomena of society rest on those of mind. It is, therefore, fitting that the first chapter in the evolution of society should be a treatise on the evolution of thought. As we have seen, primitive ideas are necessarily religious ideas. We might almost as well have said that primitive ideas are scientific ideas. They partake of the nature of both. On the one hand, they are filled with awe for the mysteries of the unknown, fear of the invisible, faith in the incomprehensible. In so far they are religious. On the other hand, they are the products of an effort to explain the unknown, they are gropings after truth, theories of the Cosmos. As such they are identical with those ideas now regarded as possessing the highest scientific purity. The truth is, that primitive ideas are simply the chaotic stage of thought. They are the *nebulæ* of future systems, both of religion and of science—the confused, undifferentiated, primordial aggregate out of which in due process of evolution will come at last both the proper reverence for the Unknowable and the fullest acquaintance with the Knowable.

A complete history of the origin, relationships, growth, and development of primitive ideas gives us the genesis of both religion and science. While we may imagine that in studying them we are tracing the genesis of religion only, with its ideas of spirits, worship, gods, etc., yet we must not forget that, inseparably connected with every religion, there is a cosmology which tends to develop into a true system of the universe—the highest aim of science. It cannot, however, be denied that in its external character the thought of the savage more closely resembles that of the modern theologian than that of the modern scientist. It sets out, like that of the former, with the teleological conception, and never forsakes it, as the theologian now frequently does, to employ the theory of mechanical causation in its stead. The savage knows nothing of natural causes, except such as he is himself able to exemplify in his own muscular actions. With this narrow induction he can only reason that all effects are produced by such causes. Not a leaf trembles in the breeze, not a wave washes the shore, but that in his mind it is the result of will. Eolus and Neptune are but the more refined embodiments in a highly civilized people of these crude conceptions of the savage. All the imaginary beings conceived as exerting this will-power are highly anthropomorphic in their character. No doubt, as Mr. Spencer maintains, they generally are originally the ghosts of dead men and women. They lose nothing of their anthropomorphic character by being gradually expanded into great and powerful deities, not even when integrated into a single supreme ruler of the universe.

Mr. Tylor's "Animism," which he has elaborated with great ability in his "Primitive Culture," was a very distinct adumbration of the general truth underlying the whole subject, and really amounts to a history of the development of the conception of Deity. It lacks only the initial idea that all worship is the worship of the ghosts of dead men, perhaps not universally true, to make it cover in a manner the whole ground of Mr. Spencer's argument. The general student of ethnography is surprised at not finding here a more definite recognition of Mr. Tylor's services in this respect. Mr. Spencer's treatise certainly contains enough that is original.

The second part of the volume is devoted to what the author calls the "Inductions of Sociology." In this place he considers systematically the principle, many times enunciated in the course of his works, of the fundamental analogy between society and an organism.* In support of this principle he brings forward an immense array of illustrations and comparisons from biology and physiology, and enters into a systematic classification of all the principal types of society found upon the globe. He admits that between a society and an organism there exist, along with the very many analogies so fully brought forward by him, a number of important points of divergence. The social organism is *discrete*, *i. e.*, while it consists of many individual units, these units are not intimately bound together like the cells of an animal or a plant, but are wholly independent of one another. In a word, the mode of integration is wholly different. A society is asymmetrical while an organism is symmetrical, *i. e.*, there is no definite and fixed *shape* to the former. Each of the units of a social organism possesses independent sensation, and is not subordinate in this respect to higher centers of sensation. It has no *sensorium*. A common mode of growth as well as of decay, in societies, is by *migration*, which has no analogy in biology. Finally, Mr. Spencer admits that the analogies between society and organic beings possess no further significance than that of showing the mutual dependence of parts displayed by both. There is no causal relation connecting the one with the other, but it is still instructive to compare the two aggregates through the several phases of their development.

It might, indeed, be said that all evolving aggregates exhibit the same analogies that are exhibited by organisms and societies. The chief service that has been done in pointing out these analogies so minutely has been that of demonstrating by means of them that society is an evolving aggregate. This was the truth that most needed demonstration, being the one commonly called in question. The denial of this proposition is fatal to all attempts to study sociology as a branch of science. No one doubts now that organisms may be legitimately so studied. When, therefore, it is shown

* Cf. Ernst Haeckel, "Das Protistenreich," S. 16–18.

that nearly all the phenomena which a living creature presents are directly comparable to exactly corresponding phenomena in society, the strongest proof that can be presented of the scientific character of social processes has been furnished. And when it is shown that society has passed through all the stages of evolution that living creatures have, and has been subject to all the laws, principles, and processes of evolution in general, the case seems to be pretty thoroughly made out. From a confused, chaotic, homogeneous state, still represented by many low tribes, there have gone on both differentiation and integration. From the several degrees of social differentiation shown by different races, a classification of societies is made possible.

Mr. Spencer establishes four general classes or principal grades of social development—the simple, the compound, the doubly compound, and the trebly compound. Roughly stated, simple societies embrace the true savages; compound societies, barbarians; doubly compound societies, semi-civilized races; and trebly compound societies, civilized and enlightened nations. Each of these great groups is further subdivided with reference to the degree to which headship prevails, and these lesser groups in turn are classified according as the races embraced under them are nomadic, partially settled, or completely settled.

This classification of societies constitutes an important contribution to ethnography, as we have only to glance over the tables to determine the true social position of any given tribe or race.

In all these stages of social progress, there are differentiation, integration, and segregation, progress toward the heterogeneous, toward the definite, accompanied by the rhythmic movements characteristic of approaching equilibration. In short, the progress of society has been brought about by the uniform laws of evolution, and certain smaller social aggregates have completed their entire course, reached the condition of equilibrium, and disappeared under the laws of final dissolution (*supra*, p. 167, note). At the same time the general process of integration, by which all the different races, nations, and societies on the globe become more and more dependent upon one another, has been constantly going on; and the time may be foreseen when all the societies on the earth will be bound together by a system of commercial, industrial, and perhaps political nerves and sinews.

In the remainder of the volume the author treats of the domestic relations, but confines himself almost exclusively to the subject of marriage. In no part of the entire work does his mastery of the facts tell more powerfully than in this. We have here a true basis in observed fact, in recorded observation, derived from real men and compiled from all quarters of the globe, which enables us to speak confidently as to the true nature of man.

The relations of the sexes, which are alone considered in Volume I, are shown to be exceedingly varied. Every one a little informed knows already that, taking the mass of mankind, even now, the preponderant form of marriage is what is popularly known as polygamy, *i. e.*, plurality of wives. Not, of course, that the greater part of the men have more than one wife, for this would require a great disparity of numbers in the sexes, which is nowhere found. But, taking the population of the globe by nations and races, by far the greater part sanction polygamy, and practice it as far as the circumstances will permit. Whatever, therefore, monogamous peoples may believe, and however sound their opinions may be respecting the benefits and the social and moral superiority of their custom, it is clearly absurd to declaim against the prevailing custom of the world and brand it as a "sister superstition." It is monogamy rather than polygamy that is on trial, and, as Mr. Spencer shows, there is a strong prejudice among polygamists against the monogamous innovation. But, besides these two principal forms of marriage, there is also a third, not uncommon among certain tribes, viz., polyandry, or a plurality of husbands. Neither is this purely exceptional and anomalous. More than a dozen tribes in the Old and New World are known to practice it, and in some peculiar districts it would seem to have grown up in harmony with the economic and industrial demands of the surroundings. In some cases its origin can be readily traced to the custom that the deceased husband's brother must marry the widow, and to that of regarding a man's wife as also the wife of all his brothers. In a number of cases, polyandry and polygyny are shown to co-exist, which would at first sight seem to be a very natural result. Indeed, in one form they no doubt always do co-exist, though polyandry then usually verges on prostitution, but as much must also be said for monogamous countries. In addition to these three settled forms of marriage, there also prevail numerous peculiar, anomalous, and unsettled customs among certain low races governing the relations of the sexes. These can scarcely be called marriage, and form the transition from simple promiscuity to the settled forms of marriage.

Many animals seem to have risen above complete promiscuity, as where the birds choose their mates, and even snakes and fishes often remain faithful to their first attachments. But, among the very lowest tribes of men, there is found a condition of absolute promiscuity, such as is exemplified by domestic animals.

Nothing is better adapted to confirm the conviction of man's animal origin than this study of the relations of the sexes. We here see that society has come into existence only through the adoption of some more or less settled form of marriage. Originally, without any guide whatever, the human race has been groping about after some plan by which its posterity could be protected. The various forms of marriage are the result of this prolonged effort. Tribes in which no marriage exists are always sparse, and can not become populous. They have no successful mode of protecting their offspring, and these consequently perish in a thousand ways before reaching maturity. In this respect they are like other animals. Temporary marriage, such as exists in some places, is better than none. Polyandry arises where a portion of the male members must spend a large part of their time away from their children. In such cases one of the husbands remains behind and protects them. Such is the case in Thibet and other mountainous pastoral regions. It becomes a substitute for pure nomadism. Among warlike tribes polygyny is the first and principal settled form of marriage. There is a peculiar adaptation of this form to militant communities, where the men are all warriors, and therefore the natural protectors of children and non-combatants. And with them the number of wives and of children is comparatively unimportant. Finally, in countries where war has ceased to form the leading occupation of the male population, and where agriculture and other peaceful industries have taken its place, the large degree of male celibacy enforced by polygyny not only becomes a positive hardship, but is opposed to the economic interests of the people. Few can support more than one wife, while each man can generally do better with one wife than with none. Hence monogamy comes to be the prevailing form of marriage among such peoples. Not only is this true of different nations having different characteristics, but it is true of individuals, groups, and classes within the same nation. Thus among the great polygamous peoples of Asia this form of marriage is chiefly confined to the influential families who are essentially militant in their modes of living, while among the lower industrial population monogamy is nearly universal. And as the industrial type of society is the only one that can be permanently maintained, and the only truly healthy condition of the race, so monogamy, which is best adapted to that type, is the form of marriage which most completely fulfills the requirements of society, and the one which, no doubt, will eventually become almost universal. I say almost, for there is a tendency on the part of a great many radical reformers to hasten the completion of nature's great cycle in this respect, and inaugurate a return to a civilized form of promiscuity. These claim, of course, that it shall possess none of the coarse and repugnant features of the savage custom, shall be founded on the absolute freedom and choice of the parties, and that offspring under their system shall receive even greater protection at the hands of the community and the parents than they receive under the monogamous system. Such idealists can not be suppressed; they can only be told that the age is not yet ripe for this mode of artificially advancing the social state, and that to most minds their ideas are repugnant. It is, nevertheless, true that there is much room for improving the system of monogamy, and undoubtedly the progress of liberal and enlightened sentiment in monogamous countries will eventually remove the present strait-jacket in which society now so awkwardly labors.

The remaining parts of the "Sociology," so far as published, furnish a fair indication of what the whole will be, but they are necessarily so laden with illustrative facts as to render them less attractive than Mr. Spencer's previous works, and afford him less opportunity to display his accustomed powers of logical analysis and his wonted originality. It is probably for this reason that some have supposed that Mr. Spencer's mental vigor was declining, but those who entertained this view were generally convinced of their mistake after the appearance of the "Data of Ethics," which he paused from his regular work to prepare.

It would scarcely be fair to pass judgment upon the work at its present stage, and we shall, therefore, forbear to discuss it, and be content to await its completion. It may not, however, be improper to remark that there are some competent ethnographers who are somewhat disappointed with his mode of treating the subjects handled in the work, and who regard some of his reasoning as unsound. The belief is growing in the minds of careful students of savage life that the ultimate basis of regulative institutions must be sought in the facts which cluster round the conception of marriage and kinship, and that the course of the evolution of government and of other institutions has been fundamentally different from that marked out by Mr. Spencer.

The "Data of Ethics."—Mr. Spencer's justification for this work, written and published in advance of its natural place in his general system in view of the possibility, if deferred, of its failing to be reached, may be gathered from the following passage of the preface: "Few things can happen more disastrous than the decay and death of a regulative system no longer fit, before another and fitter regulative system has grown up to replace it."

Readers of his works had been led to suspect his loyalty to the established code of morals by frequent previous utterances.* Such intimations were found in his earlier works which preceded his "Synthetic Philosophy," and throughout the latter this respect was occasionally manifested. It appeared strange that a writer whose works had cleaved so thoroughly the superstitions and traditions of his time, and acquired the reputation of being so radical and profound on most subjects, should evince so high a regard for the prevailing code of morals, and the world was prepared to expect in the "Data of Ethics" to find the elements, at least, of a new system of morality—a substitute for the existing system. In this it was destined to be disappointed. It is true that he would do away with the coarse incentives of fear and hope, and make conduct to spring from a higher regard for the interests of others, but this is the direction in which the prevailing system is obviously tending. His scheme of morals rests, like the old one, wholly upon the feelings, and his ideas of the manner in which conduct is to be controlled

* See "First Principles," pp. 117, 118; also, frequently in his "Study of Sociology." The passages in the "Data of Ethics" in which he most clearly intimates the necessity of an authoritative code may be found on pages 156, 162, 171, 172.

agree with those of the most ancient moralists in seeking to make human actions conform to certain standards erected by the wisdom and experience of the past. He nowhere recognizes the important facts, pointed out in the Introduction to the present work (*supra*, p. 10), that there has been no progress in the character of these rules of conduct since the days of Confucius and Hillel; that real moral advancement does not depend upon such rules, but upon the character of the people; that it is *character*, created by other circumstances, which determines the codes of ethics, and not the codes of ethics that determine the character of any people.

Failing to recognize these truths, he of course fails to recgnize the deeper truth that, if any moral progress is ever too be made other than that which would naturally be brought about by the secular influence of cosmical laws, it must be the result of an *intellectual* direction of the forces of human nature into channels of human advantage, since appeals to the emotions, though often productive of great excitement, are in the nature of things non-progressive. He does, indeed, say that "the entire field of ethics includes the two great divisions, personal and social" (p. 281), but he does not seem to think that society as a body has anything to do with either.

Mr. Spencer regards the moral phenomena from the objective and not from the subjective point of view. Life, its duration, maintenance, and perfectionment, he holds to be the supreme end.* This is what we have denominated the object of nature as contradistinguished from happiness, the sum of pleasures, which is the object of sentient beings (vol. i, pp. 461, 469; ii, 120, 132). The former considerations belong to the department of natural history. They are natural phenomena, beyond all control of the will. Hence they are not in any sense objects of *conation* (vol. ii, p. 93),

* "Data of Ethics," p. 14.

and have no connection with morals. The latter rest upon the feelings, the emotional and volitional parts of mental phenomena, and form the basis of all voluntary action. They are, therefore, the foundations of a scientific morality. This distinction has escaped Mr. Spencer throughout all his works.

This is the more remarkable, as he plants himself squarely upon utilitarian principles. Indeed, this book contains decidedly the best defense of utilitarianism that has yet been made. Its chief merit consists in the thorough and able manner in which the doctrine is pruned of its crudities, confined within its proper boundaries, and presented as a reasonable and respectable truth for acceptance.

Mr. Spencer's distinction of "absolute and relative ethics" is something of an elaboration of Kant's "pure morals," * and may form the basis for important advances in the comprehension of the true character and limits of this as yet crude science.

Finally, we may remark that the position to which Mr. Spencer assigns this science is difficult to defend. He elsewhere strenuously maintains that the character of society is determined by the character of its constituent members.† The phenomena of society as a body he also holds to be in the nature of a resultant of the activities of its individual components. And yet he places the science of sociology below that of morality, *i. e.*, considers the phenomena of the composite body prior to those of its components whose resultant it is.

Of the "Data of Ethics," as of all the rest of Mr. Spencer's works, it must be said that it persistently clings to the pure and better established statical aspects of the subject treated, rarely rising into the passively dynamic, and never into the actively dynamic (*supra*, p. 56), or applied, department. Notwithstanding the claims of his "Synthetic

* "Kritik der reinen Vernunft," S. 340.

† "First Principles," p. 133; "Principles of Sociology," vol. i, chap. ii.

Philosophy" to rank as a system, it is not itself in strictness such, though a somewhat systematic, and certainly very able, co-ordination of the greater part of all known truth. But it is expository, not constructive. This gives it a character of great solidity and respectability. All *systems* necessarily involve much that the world calls chimerical. It is impossible to construct a logical and symmetrical edifice of thought without going both below and above the familiar range of common experience, and enunciating propositions, whether true or false, which the popular mind, or even the general sentiment of the most enlightened portion of the community, will refuse to accept, and will pronounce Utopian. This fact might have been enumerated among the many modes in which human progress tends to defeat itself (vol. i, p. 75; ii, 71).

Mr. Spencer has steadfastly declined to be drawn by his logic into anything that even the most incredulous could call a vagary. No man probably ever wrote as much as he has written without saying more that the average judgment of mankind could not indorse as soon as presented. This is due to the firm manner in which his reason is enthroned, and the all-sided and practical wisdom with which his extensive information enables him to survey every problem. But it is just these qualities that render him unsystematic, non-constructive, and non-progressive. Paradoxical as it may sound, and whether it be construed as complimentary or otherwise, Mr. Spencer has too much good sense and too much real knowledge to build a perfect system of philosophy. Should he be tempted to undertake it, the objections to certain parts essential to its symmetry would present themselves so vividly that he could not resist the feeling that the whole system was vitiated and untenable, and would renounce his design. Much less could he go back to the initial steps in the aggregation of ultimate atoms, or on, to revel in dreams of future social perfection in a millennial age.

What he has given us is something wholly different from this. He has taken the materials which the world already possessed and made the most of them. He has accepted the estate which human thought and labor have bequeathed, and fitted it up for the occupancy of a higher and nobler race of beings.

CHAPTER III.

PRIMARY AGGREGATION.

COSMOGENY *—GENESIS OF MATTER—CHEMICAL RELATIONS.

Scientific categories—Matter—Motion—Force or energy—Laws of aggregation—Relation—Effect of narrow ideas of magnitude—The ultimate atom—Time and space—The true nature of force—Segregation among aggregates—Compound aggregation—Composite character of the nervous system, and the phenomena of multiple consciousness—Probable composite character of the chemical elements—Transcendental chemistry—Formation of the inorganic compounds—Cosmical history of the earth—Theory of the development of celestial systems—Cosmic and organic evolution—Radiation a counter-force to gravitation—Cosmical creation of the chemical elements—Significant relations of the bodies of the solar system—Constitution of the earth and original formation of its crust and interior—Elements and compounds compared—Organic compounds—The properties of matter considered as relations among their molecular activities—Comparison of the molecules of different elements—Properties of compounds more active than those of elements—Great relative size of the molecules of organic compounds—Continuity between the inorganic and organic compounds.

True scientific progress tends constantly to increase the number of known facts and to reduce the number of fundamental concepts. As the phenomena are multiplied and specialized, the laws are unified and generalized. As, under the law of parsimony, it is bad logic to appeal to the preternatural where the natural will suffice, so it should be regarded as bad logic to invoke two principles where one

* I have preferred this to the common form *cosmogony* chiefly for the sake of making it conform more strictly with the corresponding heads of the four following chapters. Though not in use, I believe, it is certainly immaterial, from an etymological point of view, which of these roots is employed.

principle is adequate.* It is in obedience to the first of these postulates that theology has been eliminated from science, and it is by a recognition of the second of these postulates that most of the once so numerous ontological conceptions have one by one been banished from the same field. The classification of the sciences has for one of its chief ends so to generalize their fundamental laws as to arrive as nearly at a single universal law as the human mind is capable of doing, and in this attempt the effort has also to be made to penetrate to the absolute foundation or *substratum* of the universe, and limit the number of categories until further reduction is impossible.

In pursuance of this purpose, the scientific thought of this age has successfully pruned away the complicated system of former ages until it may be said to have narrowed the bases of the universe down to three fundamental elements which may be respectively designated as *matter*, *motion*, and *energy*. In the attempts which have been made to reduce them still further, it has been sought to eliminate matter and also to eliminate energy. That one or the other of these attempts will prove successful, there is much cause to hope. The chief contest going on at the present time among scientific thinkers is between these two views. Those who would resolve matter into centers of force may be said to constitute the school of *dynamists* (vol. i, p. 158), while those who would reduce all forms of energy to modes of motion in matter should be satisfied with the designation *materialists*, notwithstanding a certain groundless stigma which popular abuse and confusion of the term have contrived to fasten upon it. Both theories are perfectly legitimate scientific attempts to enlarge the conceptions of the universe by seeking in each case to abolish a supposed redundant factor in its fundamental elements.

Whatever may be the charm of superior purity and freedom from reproach which attaches to the dynamistic theory,

* **Entia non sunt creanda præter necessitatem.**

and however well it may seem to satisfy many of the facts which nature presents, it is nevertheless true that the progress of physical science from the first has steadily pointed in the direction of the recognition of the *reality of matter*, and it has been invariably found necessary to assume such reality as an hypothesis, if for no other purpose, in order to obtain a basis for the interpretation of the facts of every science. I need but refer, in illustration of this remark, to the extraordinary development which the science of chemistry has recently undergone under the stimulus of the atomic theory, which is nothing less than a recognition of the reality and material constitution of the minute objects with which that science has to deal.

The object of all science is truth, and that of philosophy should be the same. The acceptance of the materialistic hypothesis, therefore, rather than the dynamistic one, needs no further apology than to say that it appears to bear the strongest marks of inherent verity.

Those who deny the existence of energy as an *entity*, however, do not by any means deny it as a *relation*. And this is all they are willing to admit for motion. They will concede but one entity, matter,* but this may have numerous relations which will increase in number and variety as the process of material aggregation advances. Of matter regarded as multiple there can exist two, and but two, primary relations, those of *co-existence* and *sequence*.

Besides matter itself, only the relations of matter can be conceived to exist. The most important relation of matter is motion—*i. e.*, change of position of its parts in space. This always occupies time. Changes of position of matter in space, conceived either as taking place (dynamically), or as having taken place (statically), come under the logical category of co-existence. Considered with reference to the time occupied, they belong to the logical category of sequence. These two categories embrace all conceivable or possible phenomena.

* "Tangere enim et tangi nisi corpus nulla potest res."—Lucretius.

Therefore motion, conceived both as taking place (actual) and as having taken place or capable of taking place (potential), is the one relation which involves all relations. Resolve it into its two elements, and we have on the one hand *change*, and on the other *difference*. All relations are reducible to these two.

The two questions at the bottom of all philosophy are —1. What should be understood by the term matter? and, 2. What should be understood by the term relation?

In seeking to answer the first of these questions we only state the results of all scientific investigation when we say that matter is what it seems to be. It is not the study of matter that has taught the world a contrary lesson. It is only the deductions of the intellect, divorced from the thing it would instruct us about, that have created the wide spread impression that we know nothing of matter, that the senses are false guides, and even that no such thing as matter exists.

However true it may be that early vulgar impressions are usually erroneous (vol. i, pp. 45–52), it is not thus in the case of man's intuitive ideas of the nature of matter. And, stranger still, this, which was supposed to be nature's greatest deception, proves to be no deception at all, and every truly scientific effort brought to bear upon the problem serves to vindicate more and more completely the primary deliverances of sense. The metaphysicians tell us that it is impossible for mind to come in contact with matter; that the existence of an external world is revealed to us, if revealed at all, by means of images which have no relation or resemblance to the objects which we imagine we perceive. This, physical science denies, and asserts that not only does the real matter of external objects come into actual contact with the real matter of the physical organism, but that the communications which this contact makes with the sensorium are made by means of actual changes in the matter of the nerves and the brain. The objects are not even "transfigured," but the qualities perceived are directly cognized, the form of the object depending upon the number and nature of the qualities brought into contact with sense.

But still the question will be asked, What is matter? A definition of matter is impossible. Matter is the final limit in the definition of every thing else. Any definition would involve the use of terms requiring the notion of matter to define them. When we have said that matter is what it appears to be, we have defined it as far as it admits of definition. But, while the term matter can not be defined, something may, perhaps, be said with regard to the ultimate constitution of matter. Although the vulgar impression respecting it is substantially correct, and the speculations of the metaphysicians are incorrect, it must still be admitted that the former are as crude as the latter are false. The vulgar intellect, while its practical intuitions concerning material objects are in the main just, practical, and reliable, nevertheless has no adequate conception of the subtilty of matter. It has no idea of the minuteness of its ultimate divisions. It looks upon matter wholly from a molar point of view, and knows nothing of molecular phenomena. If molecular phenomena are presented to such an intellect, they are not referred to the material category at all. The phenomena of light, heat, electricity, and even of gases, as in the atmosphere, are not considered as material agencies. But this only proves that the manifestations of matter are governed by uniform laws, whatever the magnitude of the aggregates which operate to produce those manifestations. I do not mean that there is any thing in molar phenomena which precisely corresponds with some of the manifestations of molecular phenomena, but simply that there is nothing in molecular phenomena which indicates that matter in the molecular state is controlled by any different laws from those which control it in the mass. The most successful experiments in molecular physics have been those that have proceeded on the assumption that the so-called molecular forces were simply the manifestations of ordinary matter in extremely minute particles acting relatively to each other and to other objects precisely as larger particles would act under analogous conditions.

But is there any limit to the divisibility of material molecules? Here the confines of the unknown are reached. Science simply confesses its ignorance. Science has no opinions. It either knows or it does not know. But philosophy claims this field, and, without being dogmatic, exercises the right of discussion. It is a common fallacy in human reasoning to judge all things by the standards which the human faculties set up. It is only another form of this universal anthropomorphism which looks upon matter itself from this same stand-point. Man's ideas of great and small relate to his own bodily dimensions, to the magnitude of the common objects that immediately surround him, and to the power of his senses to perceive objects. There is, therefore, a certain range of magnitude which men set up as the standard by which to compare and judge each new object; and so absolute is this standard that even wise and great men have frequently followed the example of the unthinking mass, and substituted this range of the human faculties for the range of nature's powers. We sometimes plainly gather, from the general tone of a treatise, that its author supposes it impossible that anything should be so great or so small as the hypothesis he may be combating would require. And, while few occasions arise for making an express avowal of this kind of doctrine, there is no doubt that a vague notion of the kind pervades all speculation concerning the nature of matter, and serves to render a clear conception of that nature impossible. I do not know where it has ever been positively declared and laid down as a distinct postulate of philosophy, that there is no limit to the conceivable range of magnitude among the atoms and aggregates of matter. If we adopt the hypothesis of an ultimate, finite, indivisible atom as the unit of the universe, there is really no more difficulty in conceiving that atom as much smaller than the smallest object now recognizable under the highest microscopic power yet invented as that object is smaller than the sun or Sirius, than there is in conceiving that atom large enough to be seen by such a high-power microscope. And it would be as irrational to argue that, because we are unable, with all our appliances for intensifying the power of the senses, to perceive the ultimate atom, it therefore can possess no material existence, as it would have been before these artificial appliances were invented to have argued that no object could exist too small to be seen with the naked eye. Yet it is, perhaps, not too much to say that all the refined speculations of the idealistic school, to which even scientific men have too often lent countenance, have been due to the simple fact that human ingenuity has proved unable so far to divide matter that it has not remained capable of still further division!

But, while we make bold to affirm that the known facts and laws of science are entirely satisfied with the hypothesis of an ultimate, indivisible unit of matter, of which all objects which appeal in any manner to the senses or the intellect are but aggregations, at the same time they do not, as it seems to me, conflict with such a modification of that hypothesis as assumes the actual magnitude of the material unit so far reduced as to be practically infinitesimal. They only declare, and they do this in the most emphatic manner, that this reduction must not be so far continued as to make the ultimate atom equal to zero.*

There are certain generalizations which can not be longer postponed. It may be laid down as a primary law of the human mind that, whether it contemplates matter or relation, whether it considers the magnitude or the multitude of the ultimate divisions of matter, or the time during which they

* The practice by mathematicians of confounding infinitesimal quantities with zero can not fail to be demoralizing to the causality of all students of mathematics. (See, for example, Loomis's "Algebra," Articles 129, 130.)

have existed or will continue to exist, or the space through which they extend—in none of these relations is any positive limit conceivable or thinkable. Whatever the concrete fact may be, an ultimate atom is by the laws of thought inconceivable, since, such a finite body once reached, the mind can not help declaring its further divisibility possible. Similarly no time can be fixed for the commencement of the existence of matter, but that its existence prior to that time is a necessary product of thought. The only escape from this necessity is in ceasing to think about it. Again, no limit can be set in space, either in all directions or in any direction, beyond which other space must not be necessarily thought, although the filling of that space with matter is not a necessary adjunct of this conception. And here the notions of time and space seem to differ, although the difference is not real. There is no absolute difficulty in conceiving time without matter, any more than there is in conceiving space without matter. The difficulty in the former case arises only from the fact that matter now exists, and therefore no point of time can be conceived at which it did not equally exist, or at which from non-existence it could have commenced to exist. But these have become truisms. What it interests us to remark is the necessary recognition of *infinity* as the only limit, if such it can be called, which the mind will admit of when it *really thinks* about these things. In all things we find ourselves within a limited field beholding limited parts of a whole which we are obliged to conceive as infinite. The finite is nothing else than one of these parts cut out, as it were, of this infinite whole.

Whatever is true of matter is also true of its relations. For, while relations are nothing in themselves, it is only by means of them that matter is recognizable. Perfectly inert matter, could this be conceived to exist, could produce no effect on the sentient world. The relations of matter are its properties. Matter without relations would be matter without properties. This is said to be inconceivable, but is so only in a certain sense. The primary relation or property of matter is the change of place of its particles. This implies much absolute void space and distinctly negatives the *plenum.* All the properties of matter are the results of this primary property variously compounded and complicated in the process of aggregation. This primary relation is simply motion, and the progress of experimental science is daily referring new properties, manifestations, and phenomena of the material world to this simple principle. Already heat and light are defined as "modes of motion"; electricity and magnetism are also recognized as such; and the law of the commutation of the different molecular forces into one another and into mechanical force, only goes to prove experimentally what philosophy claims *a priori,* that motion among the particles of matter is the original cause of all phenomena.

But what is force? Surely here is something which is neither matter nor motion. Not so. This mysterious entity, the latest survivor of all ontological conceptions of metaphysical speculation, is, when properly viewed, one of the readiest to take its place as a derivative relation of moving matter. It has been well said that the only rational conception of force is *pressure.** *Omnis alteratio fit per contactum.* Perhaps a still clearer conception is expressed by the term *impact.* Everybody understands the effect of the impact of bodies. It is a branch of pure mechanics whose laws have been long formulated into mathematical equations. These laws are generally applied to, and illustrated by, large aggregates of matter or masses. But they are just as true of atoms as of such masses. What is called the momentum or quantity of motion of a body represents the force with which that body will impinge upon another body with which it meets. This force is equal to the product of its velocity into its mass, *i. e.,* of the amount of matter into the amount of space it will pass through in a given time. And this is

* Challis, "Principles of Mathematical Physics."

of course true, whatever mass we may assign to the body, even though it be indefinitely small.

That matter in a primary or unaggregated state, or at least in an extremely low state of aggregation, pervades all space seems highly probable from the phenomena of light, heat, etc. That these phenomena take place without the intervention of matter is not only contrary to the laws of thought, but contradicts the testimony of sense, and is fundamentally irrational. The units of this cosmical matter are so far below the range of our faculties that it remains, and will perhaps for ever remain, impossible to determine more of their nature than is revealed by these general phenomena. Already, however, we have learned much about them, and this field of discovery is comparatively a new one. It is only for a few years that the existence of such an all-pervading medium has been admitted, but its admission has given us a comparatively clear idea of the true nature of all the radiant forces.

That the force of gravitation is another mode of manifestation of some universal material substance can scarcely be doubted, although no clear line of investigation has yet been discovered which promises to demonstrate this truth. In what manner this universal force operates to produce the effects which we constantly perceive is not yet, and may never be, known, but all analogy points to the laws of mechanical impact as the true principles upon which gravitation is to be finally explained if it ever is explained. The theory of Le Sage is doubtless crude, because no experimental proof has been brought to its support; but perhaps such a theory is not more objectionable than was the undulatory theory of light a century ago. So far at least as we know the laws of gravitation, they are in harmony with those of perpetually renewed impact, and such is the nature of all continuous force; bodies under its influence have their velocities increased at an accelerated rate, which, for short distances, is usually assumed to be an arithmetrical progression with a common difference of two. But, as the force of gravitation acts according to the law of the inverse square of the distance, this progression is not true for great distances, and the velocity of the falling body is considerably more accelerated than it would be were this not the case. Upon the hypothesis that gravitation is the result of the constant impact of material atoms whose velocities toward the attracting body are greater than in the opposite direction, it must be further assumed that either their number or their velocity is increased with increased proximity to that body in inverse proportion to the square of the distance. The former assumption is the more satisfactory, although it would seem to require that there should be a greater amount of cosmical matter near to, than remote from, attracting bodies.

There also seems to be a fundamental antithesis between the force of gravitation and that of radiation. The one appears to be the precise opposite of the other. The first is a force of concentration by which all matter is aggregated into masses, and each mass is increased by all minor aggregates that come within its sphere of attraction. The other tends constantly to unbind the material aggregates from their attracting masses and dissipate them into space (*supra*, p. 167). But to this important principle we shall presently recur. In so far as they constitute forces their laws are the same, and are one with those of the so-called mechanical forces. This is equally true of magnetism, chemical attraction, and all other forces.

Force may, therefore, be defined as *molecular impact*. It is simply *the effect which matter in its motion through space exerts upon other matter with which it comes in contact.*

The so-called mechanical forces are all merely results of the two cosmical forces referred to. They are simply the effects of these upon forms of matter with which we are familiar. It is often remarked that "every thing that is done under the sun is done by it." But while instances of the direct or indirect influence of the radiant forces are most frequent in human economic devices, instances of the utilization of gravitation for human ends are not wanting, and are well exemplified by the various applications of water-power, as well as by those of weights in machinery. But a "vicious circle" lurks in all such questions.*

We thus see that every thing which is not matter is some relation between discrete parts of matter. The only reality is matter. It alone has an independent possible existence. Such an independent existence, however, could only be on the condition that there existed but a single ultimate unit of matter. Such a single unit could have no relation, since a relation implies two things at least. Even the motion of such an atom could not be termed a relation; but the discussion of such a question would be pure dialecticism. But increase the number of such atoms, and relations necessarily arise. For, even if no motion were supposed, there would exist relations of co-existence. It is, however, a concrete fact, and as such requires nothing but simple recognition that the atoms of matter *are in motion*, at least relatively to each other, which is the only motion recognizable. Once in motion, their cessation is inconceivable. No such coincidence of impacts is possible as shall bring them all into equilibrium. The motions of material particles are as eternal as are the particles themselves. The destruction of motion is as impossible as that of matter. The creation of matter is inconceivable; it must have existed always, and hence the alleged endowment of it with properties, *i. e.*, with motion, is impossible. Such a supposed endowment implies a time when matter had no properties—no relations—which must have been a time when it had no existence. The endowment of matter with its properties is equivalent to its creation.

* For, if it be said that it is the sun's influence that first raises the water and the weights, it is also claimed that the sun's heat is in turn due to its contraction under the influence of the opposite agency of concentration or gravitation.

The basis of all philosophy, as we have remarked, is the conception of matter and its relations, and it amounts substantially to the same thing to say, matter and its motions, since all its relations are the result of its motions.

All the motions of matter fall under two general classes: those which tend to *unite* and those which tend to *separate* the particles or atoms. It is these two opposite classes of motion among the particles of matter which in their higher manifestations constitute the *gravitant* and the *radiant* forces of the universe. We see them most obviously in the force of gravity as displayed upon the earth and among the bodies of the solar system, and in the phenomena of light and heat. But the fundamental effect of these forces escapes the ordinary observation, and is indeed produced upon a scale either far too minute or far too vast to fall within the possible direct contemplation of man.

Setting out with matter assumed to exist in a wholly unaggregated and homogeneous state, but endowed with indestructible motions operating in obedience to these two laws, the necessary result must be that in certain parts of space certain kinds and degrees of aggregation of matter will take place. For, without assuming any supremacy of one class of motion over the other but their substantial equality, there will be portions of space in which the one class will preponderate over the other, although this will be balanced by other parts in which the opposite will be the case. If, therefore, we were to suppose a time when no such preponderance existed, it could not be long before this condition of homogeneity would be broken up and one of heterogeneity would result. And if at the imaginary epoch of homogeneity we assume all matter to exist in a wholly non-aggregated state, then, as, in those portions in which the force of disintegration predominated, no change could take place because no aggregates would exist there to be disintegrated, so, in those portions in which the force of aggregation existed, change *could* take place, and the aggregation of matter would be the result. On this principle there is no difficulty in accounting for any degree of aggregation without assuming an excess of concentrative over dissipative motion in the universe. For there must be supposed to exist the same rhythmic ebb and flow in these fundamental conditions of matter as are observable throughout all the higher manifestations of these conditions which we are able to study, from the action of volcanoes to the rise and fall of empires, from the roll of billows upon the beach to the progress of moral principles in society. And while it may be certain that the time must come when the aggregates now formed will all be swept away by the great ebb-tide of dissolution, compensated by a corresponding flood-tide of evolution in another region of the universe, still there is no necessary limit short of the infinite, either to the duration or to the degree of cosmical progress in those parts in which it has begun. But on the same principle it can be shown that in no part of the universe can the unaggregated state exist for an appreciable period of time. Such a state is one of absolute homogeneity, whose inherent instability is constantly able to overthrow it and bring about the only possible state of heterogeneity—a state of greater or less aggregation. The cosmical fluctuations are not therefore between the aggregated and the unaggregated state, but between states of greater aggregation and states of less aggregation.

The special study of material philosophy is therefore the aggregates of matter. From what is known of the constitution of matter, it must be supposed that there can exist no practical limit to the possible variety and multiplicity of form, size, and other conditions, in material aggregates. But, as the aggregating force is perpetually counteracted by the segregating force, it can not be doubted that the successful aggregates are determined by a sort of *selection*, those only resisting immediate disintegration which possess something special in their essential nature that fits them to resist it. In fact, the law of the "survival of the fittest," now so potent in explaining the formation and self-dependence of secondary aggregates—organic forms—must undoubtedly be called in equally to explain the possibility of the formation of primary aggregates—molecules. And as there are myriads of organic forms that have a relatively ephemeral existence, and are speedily extinguished in consequence of their constitutional unfitness to compete with other forms, and a still greater number of conceivable ones which succumb to these influences before they have fairly taken shape, so we may suppose it to be in this transcendental world of molecular existence, only a comparatively few of the conceivable combinations ever gaining a foot-hold, and many others clinging to a very feeble, precarious, and short-lived existence.

We may further with great safety assume that the process of aggregation has been from the first a system of *compounding* of aggregates previously formed. When in the process of selection already described certain states have been reached which possess sufficient stability to resist the disintegrating forces surrounding them, these must in turn become *units of aggregation* for the continuation of the process. There may thus arise an indefinite number of *orders of aggregation*, in which the units are removed in all degrees from the primordial unit of wholly unaggregated matter. To this law we see the clear analogy, at least, if not the actual continued operation in all the departments of nature which have risen high enough above the mysterious realm of molecular existence to be appreciable by our senses.

In biology we have the individuals of various orders, both animal and vegetable, in which the lower forms are taken up bodily and made to enter as integral units into the higher forms. Not only are all animals and plants compounded of innumerable cells as ultimate biological units, but the earlier forms, which are aggregations of cells, are repeated as units in the production of higher forms.

The tape-worm is an animal of the third order, the cell being taken as the first, but its segments are so feebly integrated that they possess all the essential characteristics of a perfect animal, and will not only survive when separated and perform all the functions of complete life, but will also multiply themselves and reproduce the compound organism (vol. i, pp. 183, 337, 376). In the higher *Annulosa* the integration is more complete, but the compound character is still evident. In the *Vertebrata* the embryological study of the origin and formation of the different parts shows plainly their composite character, every vertebral segment representing a unit of organization, while the number and variety of the ganglionic centers in their nervous systems are very great, and the degree of co-ordination is so incomplete that many entire classes of actions are performed, even by man, solely under the direction of special nerve-centers without the aid or even the knowledge of the brain. Thus the greater part of the difficulties and supposed mysteries of psychic phenomena have grown out of our ignorance of the physiological fact that man and all other vertebrates are compound organisms, and, instead of possessing each a single mind or *ego*, each possesses many minds, which are only more or less co-ordinated and wholly co-ordinated for longer or shorter periods, and with respect to a wider or narrower range of functions, depending on the degree of organization.

In the vegetable kingdom we have a still clearer illustration of the manner in which the aggregates are compounded. The cellular plant, as in *Caulerpa*,* consists of a simple aggregation of cells, although the form would indicate a considerable degree of organization. In higher plants the leaf forms a new order of organization, and this is usually taken to represent the true individual, although it consists of cells which undergo more or less modification in the formation of fibers, vessels, etc. In trees the process of compounding has gone so far that, considered as individuals, they may

* *Caulerpa* is said to consist of simple plastid units or cells without nuclei. —(Haeckel, "Schöpfungsgeschichte," S. 409.)

reach their hundredth degree. And in each degree we see nothing but a repetition of the one process by which stable aggregates have been made the units for further aggregation, and so on.

If we contemplate the mineral kingdom, we are shown the results of the same law. The different minerals are not found to be so many different compounds of the elementary substances, so called, but consist of compounds of different orders in which simpler compounds enter as units of composition. Thus feldspar contains silica, alumina, peroxide of iron, lime, soda, potash, magnesia, water, etc., as units of its composition, none of which is assumed to exist in the mineral in any simpler state, and all of which are already more or less complex chemical compounds.

When we consider the facts which chemistry furnishes we see the same principle or law in great simplicity. In many of the binary, ternary, and higher compounds, theory requires us to assume that the aggregates entering into them do so in their integral state, and are not first decomposed into their primary elements and then reorganized into the new compound. Sulphuric acid (H_2SO_4), for example, is composed of two equivalents of hydroxyl (HO), and of theionyl (SO_2), both of which constituents are regarded as remaining intact in their composite state and entering bodily into the new compound. The entire series of "compound radicals" requires the same supposition, and furnishes illustrations of the same law.

So far, then, as induction can be depended upon, we find that it is a universal law of the aggregation of matter that each new aggregate may become a unit for the formation of aggregates of higher orders. That such is the law of aggregation below the plane of human investigation seems, therefore, to be a necessary inference.

It is essential to form a clear conception of the nature and physical constitution of a molecular aggregate. If the ultimate atom be conceived to be a real thing—a quantity of matter physically indivisible, no matter how minute, and thus essentially impermeable and, as we may say, *infinitely dense*, nevertheless the facts of science, so far as they go, as well as the laws of thought, will not countenance a similar conception of a molecular aggregate. Whatever modifications this opinion may yet undergo, the present conception of the molecule, by those physicists and chemists whose opinions on this subject are most valuable, negatives the idea of permanent *contact* among the atoms, and regards the molecules rather as *systems of atoms.* The term "atom" as used by chemists refers, of course, to the supposed elementary units of chemistry. But the same general principle must be applied, no matter how low in the scale we may conceive aggregates to stand. If, therefore, the chemical atoms are, in fact, as we assume, aggregates of a comparatively high order, they must be supposed to stand in the same relation to the lower aggregates of which they are composed as the molecules of chemistry stand to them, and so on down to the primary atoms themselves. An interesting confirmation of this theory is to be found in the fact that, in the exact mathematical determinations of the laws governing gases, no distinction can be found between those which are regarded as elementary, such as hydrogen,† and those known to be compound, such as carbonic acid. However much they may differ in atomic weight, specific gravity, and other properties characteristic of the different gases, they are all found to obey the same general laws—the laws of gaseous action. This fact rightly viewed should, moreover, I think, afford a strong evidence of the composite nature of the elements. But this is an anticipation.

† All the permanent and easily obtainable elementary gases, as hydrogen, oxygen, nitrogen, and chlorine, are now believed to have as their units, not single chemical atoms, but molecules consisting of two such atoms combined. It can scarcely be doubted, however, that the vapor of mercury or of iron, in which the atoms are supposed to be single, would obey the law of Mariotte or of Charles as absolutely as do the permanent gases.

The nature of a molecule, then, is not different from that of a chemical atom, and this is again only that of any aggregate whatever.

In our present profound ignorance, experimentally, of the nature of the attractive force, we might find in the phenomena of gravitation, viewed simply as such, a plausible approximate explanation of the current conception of the molecular aggregate as a system of atoms or lesser component aggregates revolving around their common center of gravity, and separated from one another by distances, and moving with velocities, analogous to those of the solar and other celestial systems, according to laws which enable them to maintain their equilibrium and preserve the stable condition. But this theory is wholly unsatisfactory, and, while the analogy may be one well calculated to fascinate the reason, it must be regarded as worthless when the attempt is made to explain, by the original motions of the ultimate units of matter alone, not only the formation of aggregates of all orders, but the law of gravitation itself. That this is done here is not pretended; that it can be done is not asserted; but it is simply maintained that, so far as any one knows, gravitation is as likely to be capable of explanation as radiation, and the former does not now seem more impossible than did the latter two centuries ago.

The facts which we have with regard to molecules, and the evidences which these furnish as negativing the idea of the actual contact of the component aggregates, are valuable, and in so far seem to favor the theory of molecular systems. The systems of worlds in space may, in fact, constitute a legitimate analogy to strengthen this view; but, after all, it must be admitted that, further than the great probability that all aggregates consist of collections of lesser aggregates or of ultimate units of matter in a state of great activity, *i. e.*, motion, of which the properties of each must be taken as the index, we are as yet wholly without any satisfactory theory, not to say explanation, of the real nature of aggregates, and must remain so for the present. Yet this much is sufficient to justify us in attempting the further explanation of those higher phenomena which are capable of appealing to our senses and our intellects.

What the properties of those molecular aggregates may be whose activities can not be revealed to sense is of course unknown. Conjecture, even, as to the probable number of degrees of such aggregation, from the ultimate atom to the supposed atom of hydrogen, would of course be idle. But that such aggregates exist far down upon this inaccessible plane, having definite shapes, sizes, degrees of stability, and individual activities and properties, we are permitted, if not compelled, to assume; but as to how they may be related to the phenomena of light, heat, electricity, and gravitation, science has as yet vouchsafed no theory.

Passing over these lower stages, therefore, whose study belongs to the future of human science or to possible beings endowed with finer faculties, and which may be regarded as the domain of *transcendental chemistry*, we finally arrive at a class of aggregates of great stability, but which, though still so minute that they can only be perceived when accumulated into masses, have, nevertheless, been studied in their free state by means of the various phenomena to which they give rise, either in the natural condition, or, as is usually the case, under certain artificial conditions to which the ingenuity of man has learned to subject them. As these aggregates are the lowest which can be perceived, they have been denominated *elements*, and are by some supposed to constitute the ultimate units of matter. That this is not the case seems almost certain, and it is far more consistent with what is known of matter and with the laws of thought to regard them as the first or lowest stages of aggregation whose activities are capable of appealing to our senses either directly or indirectly. It is really no more probable that the so-called elements are the lowest subdivisions of matter than it is that the remotest stars visible are those actually at the confines of the universe.

That these so-called elements possess the power of appealing, directly or indirectly, to our senses is the sole reason of our recognizing their existence; and the history of their discovery, by which their number has been so greatly increased, shows that their modes of thus appealing are often so subtile as to escape all but the most thorough methods of detection. Many of these elements, now universally recognized, remained for a long time wholly unsuspected, and these then belonged to the great class of unknown aggregates. This interesting chapter in the history of science should be sufficient to teach us that below the known of to-day there still lies a wide belt of the knowable unknown, and that other and still lower orders of aggregates will doubtless yet be induced to reveal their existence.

Another reason for regarding these elementary substances as ultimate units has been supposed to be found in their great stability, which causes them to behave as if they were such. While there is one possible exception to this in the case of oxygen, and the peculiar phenomena of ozone and antozone, it is indeed true, so far as known, in all the remaining elements, that they have thus far resisted all attempts to decompose them. This, however, aside from the possibility of doing so still, is really no evidence of their absolutely elementary character, but only indicates what the whole theory of aggregation would admit if not require, that all aggregates which could possess the properties requisite for the composition of such masses as are capable of affecting the senses, or of so affecting other masses as to make themselves known to the human intellect by the effects produced, must possess a degree of inherent stability sufficient to resist all human efforts to disintegrate them. While, therefore, it is very probable that, just as the alkalies and alkaline earths, which at the beginning of the present century were regarded as elementary, have yielded to the galvanic battery and prove to be composite, so a few more of those now classed as elements will at no distant day be similarly decomposed by the higher appliances yet to be devised, it is nevertheless entirely consonant with the theory of the constitution of matter here maintained that there shall remain upon the plane of human investigation a greater or less number of wholly undecomposable aggregates serving as the primary basis of all tangible substances, and I see no impropriety in retaining for such aggregates the present practically correct designation of "elements." It must be expected, however, that these elements will possess all degrees of capacity for manifesting their presence, and that while some will stand out boldly, cohere in vast masses, and in various ways render themselves obvious and obtrusive, there are others which will be ever hugging the confines of the imperceptible, escaping in mysterious ways, and evading the most subtile human devices, and that only occasionally, perhaps when least expected, and for periods and under conditions such as to render their exact study difficult or impossible, will they reveal the evidence of their existence. The action of ozone and antozone represents in many respects this last condition, and may indicate the existence of substances but just within the range of man's present powers of apprehension.*

The green ray of the solar spectrum is another most interesting example, and has led eminent chemists to the conjecture at least that it may indicate an elementary substance of simpler constitution than any recognized element, if not the primary form of matter.†

Starting anew with the elements, regarded as aggregates of a comparatively high order and stable organization, but

* Inasmuch as the oxygen-molecules are assumed to be double, it is at least a legitimate hypothesis that ozone is the substance that results from the separation of the chemical atoms constituting these molecules.

† See Professor T. Sterry Hunt's address at the grave of Priestley, in 1874.

differing from one another in form, size, and atomic activities as widely as the masses they form differ in properties, the problem of the formation of the higher orders of aggregates becomes comparatively simple. We find ourselves already in the domain of experimental science where the more or less completely demonstrated laws of chemistry and molecular physics lead us up to the formation of the various inorganic and organic aggregates.

The composition of the various substances found upon the earth is readily determined by the process of decomposing these and weighing their elements. The precise conditions, however, which have resulted in their formation, and in the existing state of things in the universe, are not so easily determined, and for this purpose a further extension of the general law of material aggregation is required.

The study of the earth's crust clearly indicates that very different conditions have existed upon it in the remote past from those we now find. The facts, as a whole, prove beyond a doubt that our globe has once been in a state both of greater or less liquidity and also of great heat, and that, as its surface has cooled down, the solid parts to which alone we have access have been formed, though to what depth they extend we are still ignorant. But, notwithstanding certain doubts which have from time to time been cast upon it, the theory which was very early advanced as most in harmony with the probable history of the planet, and according to which the cooling process has not yet reached the great interior, which is therefore still in a heated and molten condition, still furnishes, perhaps, the most rational explanation yet made of the phenomena which the earth presents, and also best satisfies the *a priori* requirements. The simultaneous study of the other planets, the sun, and the earth's satellite, leads to the assumption that all these bodies constitute a single system which is not only made up of interdependent parts, the forces of attraction maintaining it in its integrity and existing configuration, but which is really homogeneous in its nature, and bears the marks of an original unity of composition.

The facts which have already been brought to light, chiefly through the telescope and the spectroscope, respecting the other visible bodies in space, are sufficient to indicate in a very satisfactory manner that the solar system is not exceptional to any great degree, and that in fact all the fixed stars, so called, are simply the self-luminous bodies of other systems fundamentally analogous to ours. It is to be expected by any one who has a clear idea of the processes of nature in general that there will be found among so many different systems a great variety in many minor respects, and so in fact we find it. The essential part of a fully developed system is that a number of bodies shall be found revolving about their common center of gravity. The absolute as well as the relative size of those bodies is immaterial, and accordingly we not only find that the systems seem to differ greatly from each other in the amount of matter composing them, but that the bodies within the same system differ in their relative proportions in all degrees. We have, for example, some systems in which there appear to be two or more bodies of nearly equal size, whose common center of gravity must therefore fall outside of any of them, and not, as in ours, within the volume of the primary. Such are most of the double and triple stars. The number of luminous bodies in any system is also independent of the hypothesis, as these same stars as well as other systems with numerous luminous bodies illustrate. And while we can say with certainty that there are systems in which several of the bodies are in the incandescent state like our sun, we may infer with at least great probability that there are many in which none of the bodies are in that state—dark systems—concerning which there seems at the present time no hope of our ever obtaining the least intelligence. The further inference that in the systems possessing luminous bodies there exist other non-luminous bodies, such as our earth and the other planets, is even more natural, and has been drawn by several eminent astronomers.

It is further quite immaterial to the theory of a homogeneous universe how dense the several bodies of any system may be. In the solar system we find the densest planet (Mercury) sixteen times denser than the least dense one (Saturn), while the Earth is four and Mercury eight times as dense as the Sun.

Diminution of density requires a proportional increase of volume, and we may conceive a body attenuated into a mere gas, and occupying a vast amount of space. An entire system may thus be imagined to consist of a single body in this rarefied state. Such, in fact, are the true *nebulæ*, and those already discovered and tested by the spectroscope present numerous gradations from this ideal initial form to states which exhibit marked traces of organization and internal differentiation. We have the spiral nebula in *Canes Venatici*, with evidence of the development of new centers near its outer limit. We have also the annular nebula in *Lyra* with a very definite organization, and we have many other remarkable forms which indicate that these nebulæ are in reality nascent systems. Moreover, certain star-systems show marks of more or less imperfection in their development, and some of the fixed stars themselves afford an uncertain and partially nebular spectrum.

Assuming the molecular aggregation of matter to have been such as we have described, we are justified in advancing a general theory for the process of molar aggregation throughout the universe. Molecular aggregation having gone on in certain parts of space according to the laws already mentioned, until in any one of these parts or regions a vast volume of matter has been accumulated in a form analogous to that which we denominate a gas, and which is still and constantly affected by its normal activities, and still in process of developing new and higher orders of aggregates, a point is at length reached in which the degree of molecular aggregation is sufficient to render the independent and discrete condition of all the molecules no longer maintainable, and a general influence begins to be felt by the entire mass, a state of unstable equilibrium, as it were, entirely pervading it. There thus arises a greater and more pronounced *consensus*, or mutual influence, among all the particles, and, from the condition in which each molecule or lesser group of molecules manifested its activities in and upon itself or only upon its immediate associates, thus only slightly or not at all affecting the whole, a condition at length comes to exist in which large groups of molecules manifest decided activities and considerably influence other like groups at greater and greater distances, exciting here vortices and there currents and waves which agitate the entire area occupied by the molecularly aggregated matter, or nebula. It could be shown that the ultimate result of this process would be finally to bring the entire nebula into some definite form of motion in a common direction. Larger masses would absorb smaller ones, stronger currents would neutralize and overcome weaker ones, and in due time the entire mass would assume a uniform motion *as a mass*, its molecular activities continuing as before. It could further be experimentally demonstrated that this general molar motion would eventually become vortical, and the nebula would sooner or later assume a more or less spherical form and commence a process of molar aggregation under the influence of the same general laws that govern molecular aggregation. The organization of systems would be the result. In this there may be an infinite variety of conditions which determine the manner in which the entire mass shall be finally aggregated, whether it shall remain in one vast mass, as it no doubt often does, or whether it shall divide up, as seems to be the more usual case, into two or more final aggregates, and what shall be the size and general relations of each of these to the rest of the system. These conditions, we say, are determined by the infinitely varied and wholly fortuitous circumstances existing in the case of each nebula, and of the different parts of its mass at different periods of its history.

From the analogy of the solar system, and from what the telescope teaches us respecting the other systems of space, it would seem to be the usual course for the nebular mass to acquire a considerable velocity of rotation about an axis before its parts become to a very great extent coherent, and in the process of contraction to throw off numerous rings of matter from its exterior, which by accident have acquired a greater cohesion for the parts of themselves than for the matter of the general mass, and which in turn become aggregated into spherical masses while still revolving about the main body, and often themselves throwing off in their turn similar rings which also assume the spherical form.

In this manner the various systems of space are supposed to have been formed, and the solar system affords so many facts pointing to such an origin and development that most astronomers now accept the general outlines of what is known as the Nebular Hypothesis, while the controversy has chiefly narrowed down to the details and minor questions involved. Space forbids, even were it deemed essential, that an extended account should be here introduced of the origin, progress, and principles of that celebrated hypothesis, which, like all other great thoughts, was a growth of the human mind, and not at all the brilliant conception of any single brain. Initiated by Giordano Bruno in the sixteenth century, it grew with Tycho Brahe and Kepler, was restated by Sir William Herschel, formally elaborated by Immanuel Kant, and after much discussion was, at length, propounded anew by Laplace with far weightier arguments than ever before, and in a great measure subjected to the tests of celestial mechanics. In its most general aspects it is in entire harmony with the law of development here formulated; and, as to the detailed questions of fact, it has been shown that, in the normal operation of that law; wide differences are not only presumable but even necessary in different systems and different nebulæ. It is not even necessary that all nebulæ should ever become differentiated into definite systems with discrete bodies. Conditions can readily be conceived in which no further progress shall ever take place than the formation of a gaseous volume, which may remain in that state for an indefinite period or be early dissipated.

It must, however, be steadily borne in mind that this gaseous or nebulous condition is one of a high degree of aggregation. Before the operations which may be designated as *molar* can commence, a degree of aggregation must be reached far exceeding that which exists in those molecules which are the vehicles of luminous radiations. The particles constituting the ethereal matter of interstellar space must be supposed to be so minute and relatively far-separated as not to exert upon one another any appreciable influence tending to produce molar aggregation or organization; just as one system in space exerts no appreciable influence upon another system. From this condition to that of a true gas the interval is analogous to that which separates star-systems from one another, as compared with that which separates the bodies of the same system.

The laws of molar aggregation, as the term is here employed, have been subjected to a profound analysis by Mr. Herbert Spencer in his "First Principles," with the chief results of which I so fully agree that I take pleasure in referring the reader to that work for the completion of the scheme which is here only begun, and which space would have forbidden me to enter upon even had there existed no such work. But in doing this I also call the reader's attention to certain considerations which may seem to him to detract from the force of Mr. Spencer's argument. For a discussion of these points, and an attempt to reconcile certain apparent inconsistencies in Mr. Spencer's system, I refer the reader to the paper on "Cosmic and Organic Evolution," already cited in the last chapter (*supra*, p. 164). I have there pointed out the fact that more than one cosmical process is called by the name of Evolution, and this not only by the public in general but by Mr. Spencer himself; and moreover that, singularly enough, the effects of the two directly opposite processes go by the same name. That this is due to a defective terminology is also there shown, and an attempt is made to apply the true principles and proper appellations. I will only further say here that the general result of this analysis is to invalidate the claims of the term *evolution* to the fundamental place assigned to it by Mr. Spencer. The two great opposing laws or principles, which underlie the phenomena of the entire universe, indeed exist, and are accurately formulated by him. The one consists in the integration of matter and the dissipation of motion, and the other in the integration of motion and the disintegration of matter. But the evolution of a solar system is brought about by the predominance of the first of these principles, while the evolution of an organism is due to the at least apparent local prevalence of the second.

The conclusion to which this points is, that some other term besides "evolution" should be employed to express these processes, and, after due consideration, the word "aggregation," also extensively employed by Mr. Spencer, has been selected as most faithfully designating the first of these processes, while the opposite process may still be called dissipation or disintegration. "Dissolution" may also sometimes be appropriate. Yet there are cases in which none of these terms will apply, and the antithesis to aggregation may sometimes be expressed by the term *segregation*. This word embodies two somewhat distinct notions, a primary one denoting the separation of groups and a secondary one denoting the selection of similar units. Mr. Spencer, as already shown (*supra*, p. 165), has made it fill an important place in his system. The phenomena of segregation do not arise until the process of molar aggregation comes to be strongly counteracted by the opposite process, and under the joint action of the two processes groups of like units are formed. Such groups of like units constitute the homogeneous aggregates, *i. e.*, the various substances, of which matter is composed. The great law of progress in the universe, therefore, is the law of aggregation, and evolution is due to the resistance which this law meets with from the opposite law of dispersion, out of which conflict not only substances and worlds but organic forms are evolved.

I can not refrain from expressing my regrets that Mr. Spencer should have left unwritten the two volumes on "Inorganic Evolution" which he admits were necessary to complete his scheme of philosophy.* I should have expected to find in that treatise a complete exposition of the chief principles which have governed the activities of the material elements throughout the entire process of world-making, from the gaseous nebula to the "burned-out star." But, in the absence of any systematic treatment of this subject, let us endeavor briefly and rapidly to follow the process of aggregation from the point at which a gaseous nebula has been fairly formed to its complete organization into a system.

Before commencing, however, we must gain a somewhat clearer idea of what constitutes a nebula. If we define this primary condition as gaseous, we should not by any means imply that it consists of a single homogeneous gas, such as would be represented by any of the gases known to chemistry. If the so-called chemical elements are simply so many stable molecular aggregates whose differences are due to different modes and degrees of aggregation, then the gases of our earth are simply the most diffused state in which masses of these aggregates can be obtained. A gas is a diffused mass of homogeneous aggregates, and this definition is as true of the compound gases, steam, carbonic acid, or vapor

* See his letter to the "North American Review," published in Appendix to "Biology" vol. i, p. 479; also, "Sociology," vol. i, p. 3.

of alcohol, as of the simple ones, such as vapor of mercury, hydrogen, nitrogen, or chlorine, the last named of which is visible to the naked eye. It might, then, be naturally supposed that the matter of a nebula would contain a number of such gases; and, as it is scarcely to be presumed that all the modes of forming aggregates sufficiently stable to resist decomposition are represented on our planet, so, in addition to some of those found here, it is reasonable to expect that a nebula will contain some not known to us.

In so far as the spectroscope, to which indeed we owe our positive evidence of the existence of true nebulæ, is able to inform us, this view is confirmed. Two of our commonest gases, hydrogen and nitrogen, have been identified in nebulæ, and at least one which has not yet been identified with any element with which we are acquainted. When we consider what kind of things these nebulæ are as objects of scientific observation, it seems wonderful that even this much should have been positively learned of their nature.

Every modification of the nebular hypothesis yet put forth has been compelled to assume that the original nebulous mass is in an incandescent state at the period when its condensation begins. This requirement has been the chief objection to the hypothesis, and many have declared that no reason could be given for supposing diffused gaseous matter to be thus affected. Whence comes this heat? The only probable source is the friction of the gaseous molecules among themselves. But can this be violent enough in so rare a medium?

To get rid of this difficulty it may be supposed that the heated condition may have been a secondary one, and due, in fact, to the aggregation of matter. No reason exists why cold particles may not become collected into a diffused mass. The inherent motions of these particles are not diminished, neither are they increased, by such a grouping. But, these motions remaining the same, their circuits are diminished by association with other particles, and an effect may be conceived to take place, even among molecules, analogous to that which we daily observe to convert mechanical motion into heat. Or, to speak more definitely, this massing of the molecules and the consequent shortening and multiplying of their circuits of motion eventually extend to the lesser aggregates constituting the omnipresent interstellar ether in such a manner as to transmit some of the longer vibrations, at least, to our eyes and produce the sensation of light. Such an effect must, however, be accompanied by heat, and when we consider by what violent motions such a mass must be agitated in order finally to set itself revolving upon a general axis, it may not be too much to expect that from this agitation heat will be evolved. Certain it is that all visible nebulæ are in a self-luminous state. It can not be known, however, how many there may be which have not yet reached the self-luminous state, and are therefore invisible to us.

It does not seem necessary to suppose that the subsequent contraction of a nebulous mass either is due to this high temperature or requires it. The tendency of all matter under the law of gravitation, considered as an unexplained fact, is toward concentration. The evolution of heat is rather the check put upon this tendency, and, in so far as it exerts an influence, exerts it in a direction the reverse of gravitation. It is an illustration of the perpetual rhythm between the forces of concentration and diffusion. When, for any reason, the former acquires an impetus which carries it to great lengths, it is resisted with greater and greater violence by the antithetical forces evolving great heat and eventually restoring the normal equilibrium, or at least the true ratio existing between the two, in the portion of space in which the phenomena occur. It seems altogether probable, therefore, that in the process of contraction of a nebulous mass, and its formation into a true system of worlds, the amount of heat radiated is in the end equal to the amount produced by condensation, which disposes entirely of the supposition that there must exist an incandescent nebula at the outset.

The so-called "cooling off" is only apparent, and, while at times the amount of heat may be diminished, at other times it will be correspondingly increased. If the radiation of heat from the surface of a body into space tends to cool it off, so does the constant diminution of its volume without loss of mass tend to heat it, and throughout its career these two influences must antagonize each other. It is only after the limit to possible contraction, due to the nature of matter itself, begins to be reached, that the amount of radiation of heat comes greatly to exceed the amount of its generation, and that the body actually begins to cool off.

This brings us to the consideration of the nature of this form of material, or molar, aggregation which results in the formation of world-systems. From our terrestrial point of view, dealing chiefly with solids, it seems to us at first sight as if the solid form of matter was the normal or primary form. Chemistry, it is true, disabuses us of this idea, but it is not until we contemplate the entire history of our globe and system that we fairly realize how modern and, as it were, exceptional the solid form of matter is. Most of the gases known to us are simply the most diffused state obtainable of the elementary substances of the globe. Few now need be told that all matter can, actually or theoretically, be made to assume either the solid, liquid, or gaseous condition. Only a few substances, such as carbon, have failed to yield to the attempts that have been made to volatilize them, while quite recently the most obstinate of the gases have been liquefied and solidified. The liquid state is intermediate between the solid and the gaseous, and, though often appearing very distinct from either, has been repeatedly shown to be capable of exhibiting all the intermediate stages. Still, each substance has, it would seem, a definite plane for each of these states or forms, and when it is compelled to surrender one it passes over all intermediate ones and assumes the next state, and so on. Now, the physical fact which renders these forms distinct is, so far as experiment has been able to indicate, difference in the length of the path or orbit in which the molecules move. In a gas the molecules describe long paths and move freely about among one another in definite ways and with fixed velocities. In liquids they describe much shorter orbits, and come much more frequently into contact with one another. In solids the distances traveled are still less, the orbits fixed, and the number of contacts much more frequent. In gases there is ready diffusion of molecules according to a fixed law. In liquids the molecules intermingle much less rapidly, but motions may be communicated with some ease. In solids the molecules no longer diffuse, though motions are readily propagated. But, besides these so-called perfect gases, liquids, and solids, there are all shades of intermediate forms connecting them.

It is essential to distinguish clearly what are here denominated *molecular aggregates* from *molar aggregates.*

Molecular aggregates, as already defined, consist of atoms of primary matter, or of compounds of such atoms in different degrees of aggregation. Every such aggregate constitutes, therefore, a true *molecule*, and is not different, except in the many degrees of aggregation to which the present theory assumes all matter to be subject, from the chemist's conception of a molecule.

A molar aggregate consists of a volume of matter, all the molecules of which are *alike.* It is a homogeneous mass of matter—a quantity of like molecules aggregated together. Any gas is a molar aggregate, while each of its molecules is a molecular aggregate of the same *species.* The same is of course true of any liquid or any solid, since these are only different forms which all molar aggregates may assume under proper conditions without altering their identity. For brevity's sake, molecular aggregates, thus defined, may be designated simply as *molecules*, while molar aggregates may with entire propriety be called *masses.*

The different chemical elements are, therefore, so many distinct species of molecular aggregates, or molecules, while the different molar aggregates, or masses, which the aggregation of many such molecules results in, may be understood as so many distinct *substances.*

It may be further remarked, as a fact of great importance in the organization of masses of matter, that the process of integration is attended by a constant tendency to segregation, which, as Mr. Spencer shows, affects masses and becomes the true element of organization throughout the entire process of evolution. It only requires to be added here that this segregative tendency extends to molecules also, and it is really this which renders the distinct existence of molar aggregates possible. But for this law of segregation, by which like molecules gravitate toward one another, there could exist no distinct *substances,* such as iron, carbon, or nitrogen, and the molecules of all these substances would be promiscuously commingled, resulting in a typical chaos. But under the law that "like seeks like," which may, indeed, be capable of a physical explanation, the molecules of the same species cohere more strongly with one another than with those of different species, and form masses of more or less definite extent and regularity of outline. It need not be repeated that the theory of the constitution of matter now quite firmly established upon an experimental basis, does not permit any constant contact of these molecules in the mass, either in the gaseous, liquid, or solid condition, but only occasional or oft-repeated contacts due to unceasing activities in more or less definite paths, orbits, or circuits of greater or less extent and in longer or shorter periods.

As there is no necessary limit to the possible minuteness of molecules, so there need be none to their possible magnitude. A molecule, large enough to be seen and handled, might be conceived, as well as one $\frac{1}{5,000,000,000}$ of an inch in diameter, which corresponds to some of the measurements. But it seems to be a concrete fact that the only molecules which actually do form masses are such as lie within certain limits, the largest of which are vastly below the capacity of the highest microscopic power to detect them, while the least are far less minute than the units of the ethereal medium.

Every nebula must consist of molar matter, *i. e.*, of molecular aggregates which fall within the range necessary to render them capable of molar aggregation, and in point of fact each does consist of several or many species of such molecules and of the corresponding substances produced by their molar aggregation. Beyond the few valuable facts which the spectroscope has revealed to us respecting the score of true nebulæ determinable in the heavens, we know absolutely nothing of what nebulæ are. The nebular hypothesis, however, is far older than the spectroscope, and in that instrument it has certainly found a faithful defender, so far as it has gone, and this at the precise point where defense was most needed. It was from the strong array of cumulative evidence which the solar system affords that the nebular hypothesis (not so called by Kant, or until recently) was formulated. This evidence points, with scarcely an adverse fact, to the *development* of the solar system out of an original mass of matter, in which all the planets and satellites were embraced, and existed in a diffused state. The incandescent condition of this matter is required by chemistry as well as by physics, since there are in our globe many substances whose existence in the gaseous state presupposes great heat. The heat required to volatilize the metals is enormous, and there are certain other substances, such as silicon, for which still greater temperatures are demanded. It may, however, be a question whether these substances can not exist in nebulæ at low temperatures in a condition not strictly gaseous, but really solid, only in exceedingly minute molar aggregates, as a sort of "cosmical dust" or mist.

It is much more probable, however, that these substances, requiring so great heat to liquefy and volatilize them, have been *created*, *i. e.*, *developed*, during the progress of the formation of the system, out of materials already existing in other forms and states of aggregation. On the assumption that, during the earlier part, and perhaps during all but the very latest period, of this process, the temperature of the nascent system is increasing, it is reasonable to suppose that the intense heat would cause the breaking up of some of the molecular aggregates which were capable of maintaining the gaseous form at low temperatures, and would at the same time cause the formation of new aggregates only capable of maintaining that form under the high temperatures to which they were subjected at the time of their formation, many of which, nevertheless, would prove sufficiently stable to preserve their own new form of aggregation after the temperature should go down, and, instead of reverting to their former condition on the cooling of the system, would assume successively the liquid and the solid conditions, and become constituent parts of, and distinct substances in, the cooled-off planets.

This theory of the origin of all those terrestrial substances which require great heat to liquefy or separate them into gas is supported by some facts. In the first place, none of the gases of these substances have been discovered to exist in any of the nebulæ. The only two terrestrial substances thus far determined with any certainty are hydrogen and nitrogen. The latter of these exists in a free state in the earth's atmosphere, forming about four fifths of its volume and over three fourths of its weight. The former does not exist in a free state in the atmosphere, in consequence of its strong affinity for oxygen, which is present there in excess, and whose union with it forms the waters of our globe. Both of these substances are gases at all temperatures producible by artificial means, and have only very recently been made to assume the liquid and solid states by the use of extraordinary devices involving immense pressure accompanied by intense cold.

The other definite line which the spectrum of certain nebulæ presents is near to that of barium, but is conceded not to be the barium-line. It is, therefore, an unknown substance, and nothing can be said of its properties. Its proximity to the barium-line in the spectrum can not certainly be taken to indicate any special resemblance to that metal, and it is probably a gas at low temperatures like hydrogen and nitrogen.

In the second place, as to these last two substances, one of them (hydrogen) is present in nearly or quite all the self-luminous bodies whose spectra have been observed, where it seems to occupy a position far out in the upper atmosphere. As to nitrogen, its presence in such bodies is doubtful so far as the spectroscope is able to inform us, but, as it exists in such quantities in the earth and our atmosphere, the belief is strong, especially among those who accept the nebular hypothesis, that the failure to discover it there is due to our imperfect methods, or to our ignorance of the manner in which the phenomena of the spectroscope are to be interpreted.

The recent triumph of science, in the discovery of oxygen in the sun by Dr. Henry Draper, only serves to show how easy it is to overlook facts all the while perceptible, and gives great hope that not only nitrogen but many other substances will yet be found there, which some have thought could not be there because not yet discovered. The fact that an element exists in the earth may not be proof that it must exist in the sun, even on the assumption that the sun is the parent of all the planets, but it is strong presumptive evidence that it is also there. It is, however, much stronger proof that it existed in the general mass as late at least as when the earth was formed out of it, and therefore in the original nebula, as shown by observation on other nebulæ. It is an interesting fact, however, that there should be found in the spectra of nebulæ a line easily identifiable as that of our abundant gas nitrogen, which the spectrum of the sun does not yield. It must be remembered that the spectrum of a nebula belongs to a different class from that of the sun, consisting of bright lines on a dark ground, which indicates a luminous gas, the latter consisting of dark lines on a bright ground, indicating an incandescent solid or liquid interior, the rays of which pass through a cooler gaseous atmosphere. Now this antithesis in the constitution of the two bodies may explain why certain elements existing in both may be capable of spectroscopic determination only in one, owing to peculiar conditions supplied by the special nature of the substances themselves; for it is by no means probable that the spectroscope gives us an account of all the substances existing in the bodies examined by it.

While, therefore, there is nothing in the facts thus far discovered which is opposed to the theory that the terrestrial substances having high melting and volatilizing points have been developed out of aggregates which are gaseous at lower temperatures in the process of evolution of planetary systems, these facts, so far as they apply, appear to favor such an hypothesis. We certainly find such substances in our earth and in the intensely heated bodies of space, as well as in such meteoric aggregates as from time to time reach our planet, and we have not yet found any such in any nebula. If the latter be conceived as gaseous, and the solar system be conceived as only a developed state of one of them, either some such hypothesis must be brought forward to explain the existence of such substances in the earth, or the original mass must be supposed to possess a sufficient degree of heat to maintain them in the gaseous form, which would be enormous. And on the theory here advanced of the origin of nebulæ themselves, the assumption of so great an initial temperature is wholly inadmissible. Prior to the state in which the degree of molar aggregation is sufficient to occasion a great amount of friction, the temperature of the primary molecular aggregates must be nearly that of space, and it can rise only as increase of aggregation and molar motion increases that friction and converts material motion into ethereal vibration. Nebulæ must, therefore, possess a long history, of which neither the telescope nor the spectroscope can give any record—the pre-luminous period—in which, of course, no gases can exist except those, like hydrogen and nitrogen, which maintain their gaseous form under extremely low temperatures. And it is reasonable to suppose that during this period other gases may exist associated with these, which, however, unlike them, are unable to sustain the successively higher and higher temperatures which the nebula acquires in its process of concentration and organization into a system, and at certain stages of this process are dissociated and resolved into aggregates of a different constitution suited to these temperatures. It is further reasonable that some of these latter new aggregates should assume the liquid and solid forms at temperatures still high as compared with those to which we are accustomed, and should constitute in the cooled crust of planets the metals calcium, aluminium, etc., as well as silicon. Indeed, it would not be at all difficult, on this assumption, to account for the existence of all the elements found on the earth, were it known for a certainty that none existed in the parent nebula except the three of which the spectroscope furnishes the proof.

We will leave it to the nebular hypothesis to explain the progress of the nebulous mass from the early luminous state to which we have traced it down to that in which the several planetary bodies have been disengaged and formed, assuming the reader to be already familiar with both the evidence in its favor and the somewhat inharmonious inferences which have been drawn from it, all converging, nevertheless, toward the development of one of the grandest of human conceptions—the evolution of the solar system.

Leaving all other systems out of view for the time being, and contemplating our own, we have next to consider the closing, as we have just considered the opening, scenes in the great drama of cosmical organization.

At the epoch in the history of our system in which we live, we observe that from the central mass eight planets, varying greatly in size, volume, density, and other characteristics, and agreeing in many respects, have been disengaged and not only formed into spheroidal bodies, but so far cooled down as to be no longer self-luminous after the manner of the nucleus or sun and of other fixed stars. In addition to these a great number of smaller bodies are found to occupy the space intermediate between Mars and Jupiter, while the existence of a ninth planet within the orbit of Mercury has been suspected. Innumerable other bodies, under the names of comets, aërolites, and meteorites, are also observed to be constantly flying through the interplanetary spaces, many of which are known to move in orbits around the sun. It is, moreover, now believed that all the space of the solar system is occupied by minute cosmical particles or dust, the chemical constitution of which is identical with that of comets and aërolites; and the zodiacal light, if not a terrestrial phenomenon, may indicate that this matter increases in density with its proximity to the sun.

The sun itself is the only one of the bodies in the system which is still so greatly heated as to be incandescent at its surface. This may be accounted for by its great size and low density. Its diameter is about 111 times that of the earth, its volume therefore over 1,400,000 times that of the earth, and, although its density is only one fourth of the earth's density, its mass or quantity of matter still remains more than 350,000 times the earth's mass. How near the sun comes to containing all the matter of the system, may be appreciated when we consider that all the rest of the matter contained in it constitutes only $\frac{1}{600}$ of the volume, or $\frac{1}{746}$ of the mass, of the sun and planets combined. The sun contains, therefore, $\frac{745}{746}$* of the matter of the solar system, a fraction so near to unity that for all rough esti-

* Calling the mass of the sun alone 1,000,000,000, that of all the planets will be 1,341,687, and of the sun and planets, 1,001,341,687. The mass of the sun is therefore 99·866 per cent of the entire system. (See Newcomb's "Popular Astronomy," New York, 1878, p. 238.)

mates the matter of the solar system not embraced in the sun's volume may be disregarded. The great nebula, therefore, out of which the solar system has been evolved has, in its course of contraction, concentration, and integration, only lost a few comparatively minute films of matter, while the chief bulk of it still clings to the primary mass. This mass, as we may infer from its rarity, is still contracting and integrating at so rapid a rate that the amount of heat thereby generated is less than overbalanced by the amount radiated from its surface; in other words, it has not probably yet commenced to cool off. For, as has already been remarked, this stage can not be reached until the process of molar aggregation has proceeded so far that but little further contraction can take place under the laws of the constitution of matter; since it is concentration of matter, or integration, which evolves heat by the conversion of material into ethereal motion, and this is really nothing more than simple friction among the molecules. As long as this can actively take place, heat will result, but as soon as a state is reached at which these activities are checked and as it were clogged, then they actually cease in a measure, the friction is diminished, and with it the evolution of heat.

A further evidence that such is the true present condition of the sun is found in what is known of its physical constitution. Its low density is due to this constitution more than to the specific gravity of the materials of which it is composed. Besides the lighter bodies, such as hydrogen, sodium, magnesium, etc., the sun is also known to contain vast quantities of the heavier metals, such as iron, nickel, zinc, copper, and probably also gold. The low density of the sun is therefore chiefly due to the fact that a large part of its volume consists of these materials in a gaseous form; and we know, from observation upon the corona and from the phenomena of sun-spots, that this is the case. To so great an extent is the sun a gaseous body, that its outline and volume have been observed to undergo variations, the matter of its substance surging first to one side and then to the other to a degree sufficient to render observations based on the contact of a planet in transit unreliable. Not only has it a very thick atmosphere (chromosphere), composed chiefly of hydrogen gas, but beneath this lies the photosphere of unknown depth, which is believed also to be wholly gaseous, and in which profound chasms frequently open, whose relatively darker color at the bottom produces the so-called spots on the sun. As to what lies beneath this, we can only speculate; but it is not improbable that it may consist of the heavier materials which are supposed to make up the interior mass of our globe, but which are there in a semi-gaseous condition due to increased temperature.

The stray little cloudlets which have chanced to become disengaged from the contracting mass and have formed the various planets, although in a highly heated state at that time, have all passed the point at which the generation of heat balanced its radiation, and, left far out in space by the receding nucleus whose radiant influence has been constantly diminishing, they have, in consequence of the small amount of matter composing them, for the most part ceased rapidly to contract and diminish in volume, and have become crusted over with a layer of solid matter. That this is the case with all the planets can not be affirmed, and indeed with regard to Jupiter, and perhaps Saturn also, it is now generally believed that the matter composing them is still in an incandescent state at the surface, and is only obscured by the immense atmosphere of dense vapors that constantly hang over the seething caldron below. This condition of things, which is inferred almost wholly from telescopic observation of Jupiter, can be deduced with great fidelity from the analogy of the earth on the assumption of complete homogeneity in the two planets. Suppose the present crust of the earth raised to a temperature sufficient to melt all the rocks of which it consists. The waters of the ocean would be converted into steam at the surface and driven far upward into the upper regions of the atmosphere. There, meeting with colder strata, they would be condensed into vapor and hang heavily over the entire earth, wholly obscuring the view of the surface of the planet from observers on other planets. Whenever, by the interaction of currents of different temperatures, further condensation should be caused and torrents of water be poured back upon the planet's surface, the intense heat of the latter would again convert this water into steam long before it could reach it, and send it back to the upper regions, to be again condensed and poured down, and again hurled back in an unceasing storm. When we imagine all the waters of the ocean, lakes, rivers, etc., on the surface of the globe converted into steam and aqueous vapor, we can readily conceive what an enormous atmosphere of this gas would surround the heavier portions of the earth's substance. In fact, it requires no profound exercise of mathematics to calculate with considerable accuracy the dimensions of this envelope. The average depth of the ocean is estimated at 12,000 feet, while the area of the earth's surface occupied by it is not far from 140,000,000 square miles. The product of these dimensions gives approximately the quantity of water on the globe. By reducing the depth, say to 8,000 feet, so as to equalize it over the entire surface, we have an easy method of computing the effect of its expansion into gas. Water on being converted into steam increases in volume 1,800 times. If, on any given area, this increase of volume be supposed to take place in vertical thickness only, we should have for the depth of the aqueous atmosphere 2,727 miles. This will, of course, be diminished by the fact that the superficial area of a sphere increases with the diameter, but this reduction is easily made. The fact that a large part of this steam would necessarily exist at all times in a state of cloud or vapor, would also greatly affect the computation; and the correction for this source would be difficult to make with any great degree of accuracy. But, with all the difficulties of the problem, it is quite easy to form a general mental conception of the degree to which the volume of the earth would be extended. And in the same degree would its density be diminished. Its surface would also present a constant state of agitation, variation, and disturbance, analogous to that presented by the surface of Jupiter, meteorological phenomena going on on a scale proportional to the depth of the atmosphere, and the degree of heat at the surface of the planet proper.

These considerations may serve to account for the great rarity of the matter of the outer planets, although it must be confessed that it is not sufficient of itself fully to explain this, especially in the case of Saturn, which, though a smaller planet than Jupiter, is little more than half as dense, and is nearly eight times as rare as the earth.

The constitution of the outer planets—Jupiter, Saturn, Uranus, and Neptune—must be in some manner different from that of the inner. The habit of speaking of the two groups as though they were substantially similar has been justly criticised, for not only is there no comparison in the amount of matter contained by them, but there is a great and radical difference in the mode of aggregation of that matter. Of all the matter of the solar system exclusive of the sun, Jupiter alone furnishes over 70 per cent, while all the inner planets together only furnish ·0044, or less than one half of one per cent. It appears, therefore, that the great bulk of the matter which was thrown off by the contracting nebula was lost near the periphery of what we now regard as the limits of the solar system: first, in two large masses; then a third, several times larger than both the preceding; and finally a fourth, more than three times as large as the third; and that after this no losses of any comparative magnitude took place.

Now, while it might be reasonable to expect that, according to the theory of aggregation here set forth, the nature of the matter which was separated from the vast gaseous nebula at the period when it extended continuously to the orbit of Jupiter, Saturn, or Neptune, would differ in many respects from that which disengaged itself from this denser ball of fire at the time when its outer border coincided with the orbit of Mars or of the earth; and, while in this circumstance doubtless must lie in part the explanation of the immense differences in the densities of the outer and inner series of planets, there are nevertheless other valid grounds on which to account for the greater part of this difference, even were it established that, in its essential nature, the matter of all the planets is strictly homogeneous. These grounds are furnished chiefly by the enormous disproportion between the masses of the two classes of bodies, as affecting the history of their cosmical development.

For example, while the mass of Jupiter is 338 times that of the earth, its distance from the sun is only 5·2 times the distance of the earth. Although the rate of contraction of the sun's mass was doubtless less rapid as it progressed, still the difference in the ages of Jupiter and the earth could bear no proportion to the difference of their masses. Jupiter is of course many times older than the earth, but it is several hundred times greater. The same is also true to a greatly diminished extent of Saturn, the amount of matter in that planet being ten times as much greater than that in the earth as its distance from the sun is greater than the earth's distance. When, however, we consider Uranus, and especially Neptune, these differences disappear, and the masses become relatively less than their distances from the sun.

In the case of Jupiter it is clear that, judging solely from the analogy of the earth, sufficient time has not yet elapsed in which to expect that this comparatively vast mass of matter would have so far contracted as to cease to generate heat, or to have radiated enough of its original heat to form a crust like that of the earth. It accordingly appears to be in something the same condition in which the earth was before its crust was formed, and while the rocks composing it were in a molten state, and the waters of its present seas were floating above it in the form of steam and aqueous vapor. Observations upon Jupiter indicate with great certainty that its vast cloud-atmosphere consists chiefly of the same matter as our terrestrial clouds, and it is a reasonable inference that these are mingled with an invisible gaseous atmosphere analogous to our own. This, however, must be much more dense, due to increased gravitation; though the latter would be in great part counteracted by the effect of heat at the surface.

Saturn, too, is known to possess a great cloud-envelope, and has been thought by some to be nearly altogether gaseous. Its astonishing rarity seems almost to require this assumption, while certain remarkable phenomena which it has been known to present, whereby it seems actually to undergo a change of shape, strongly confirm this view. This planet, therefore, is probably also in an intensely heated state, and is still contracting its mass. In short, Jupiter and Saturn are simply lesser suns, and, notwithstanding the immense difference between their dimensions and those of the sun, the solar system may be regarded as a sort of triple star.

Of the two outer planets, Uranus and Neptune, little more can be said than that they are very large bodies; the smaller of them containing nearly seven times as much matter as all the inner planets combined, and that they rank in density along with Jupiter, Saturn, and the sun, and must therefore be classed with these as, to a great extent, gaseous bodies.

In all these outer planets, as in the sun, we therefore perceive that the process of integration and concentration of matter has not reached a stage comparable with that which the interior planets present. While the latter are absolutely much younger, they are relatively far older than the former; the great difference in the cosmical progress of the two classes of bodies being doubtless due in large part to the difference of size. The case of our moon, which is nearly as much smaller (in quantity of matter) than the earth as the earth is smaller than Saturn, and which has advanced so much farther than the earth as to have absorbed into its solid matter both its waters and its atmosphere, still further illustrates this general tendency of bodies to condense in volume and radiate their heat in proportion to their mass.

But still it must be confessed that much remains unexplained. Why should Saturn be so much lighter than Jupiter, and Neptune so much heavier than Uranus or Saturn?

It must be remembered that the distances of these outer planets from one another bear some relation to their dimensions as compared with the distances and dimensions of the inner group. While Saturn is nearly as far from Jupiter as Jupiter is from the sun, Uranus is nearly twice, and Neptune over three times, as far from the sun as Saturn. These two latter must therefore be vastly older than the two former, and on the theory, being much smaller, should be far more dense. But, in point of fact, Neptune, the outer, agrees substantially with Jupiter, while Uranus agrees quite closely with Saturn.

These facts and certain others lead us to make the further assumption that there may be fundamental differences in the constitution of the matter composing the different bodies of the solar system. In other words, it seems necessary to suppose that the substances composing different planets are more or less different, or rather that, of the many distinct substances or molar aggregates which have been evolved in the course of development of the system from its nebulous condition, some of them will prevail in some of the disengaged masses and others in others, and that on this circumstance, which may be partly accidental, will depend the chief characteristics of these bodies. Of the actual chemical constitution of these outer planets we have no direct (*i. e.*, spectroscopic) information. The masses of condensed vapor that surround them can do nothing but reflect the light of the sun. It is quite evident that no very large proportion of the mass of these bodies can consist of the materials which form the original crust of the earth, unless they exist in the gaseous state. The assumption of a core of molten matter of this class would require that core to be very small in proportion to the gaseous envelope surrounding it. Such may, it is true, be the case, and this would fully harmonize with theory. But another explanation may be proposed.

Assuming, as we have done, that the nebula out of which the solar system has been evolved was originally at a low temperature which constantly increased, and that it originally consisted of a few substances which are gaseous at very low temperatures, out of which, under the influence of increasing heat, all the other chemical substances were formed by the breaking up of portions of the original ones, we may well doubt whether, at the time when the extreme outer planets were liberated, all the heavier substances had yet been formed. Iron, gold, zinc, copper, platinum, etc., might not as yet have been born, as it were, and this would explain the far greater rarity of the outer than the inner planets. Or it may be that these heavier substances, though present in the contracting mass, did not find their way out to the extreme periphery from which the materials for these planets were taken. We know from the specific gravity of the whole earth, which is nearly five and a half times that of water and about double the average density of the matter composing its crust (exclusive of the waters), that the matter of its interior must be nearly three times as dense as that of its exterior (not counting the gaseous envelope). The moon, too, which is supposed to have once formed a part of the earth, and been thrown off from its extreme outer portion in the same manner in which the earth and other planets were thrown off from the sun, proves to have a density but little more than half that of the earth, or about that of the earth's present solid crust, notwithstanding that it has progressed so much further in the process of integration of its matter.

This fact would seem to indicate that, as a rule, planets will diminish in density in proportion to their distances from the sun, of which law Mercury furnishes still another confirmation, with its density of more than double that of the other three planets in the same group. This law, however, is only general, and can not be traced in all the individual cases, as the densities of the outer, as well as of these three of the inner group, when compared with each other, attest. Still it is, perhaps, as uniform as ought to be expected.

The differences in density between the four inner planets are small as compared with the difference between the density of the inner planets, taken as a group, and that of the outer, taken as a group. The average density of the former is nearly six times the average density of the latter, while the density of Mercury, the heaviest of the inner planets, is considerably less than three times that of Mars, the lightest. It will be further observed that, in harmony with our theory, the most external of this group (Mars) is also the least dense, while the most internal (Mercury) is the most dense; only Venus and the Earth should be transposed to render the scheme true for all. But the difference of density of these two last-mentioned bodies is comparatively small.

These relations of density are thus specially dwelt upon because it is this characteristic which indicates the degree of integration and the mode of aggregation in the body, and hence alone enables us to form a conception of its nature and constitution. This and the information furnished by the telescope enable us to say with reasonable certainty that these four interior planets of the solar system are substantially homogeneous, and that a tolerably correct idea of them all may be formed from the character of the earth.

This statement, however, is wholly exclusive of all but their mineral condition. Organic life is influenced by such exceedingly delicate conditions that no inferences with regard to its existence on other planets can be deduced from any of the facts above set forth, but must be drawn from another and far more difficult class of considerations, if they are ever drawn at all.

Leaving, then, all others for the time being out of view, let us consider for a moment the matter of our globe. We find it to consist of a large number of distinct substances, of which some sixty-five * have thus far resisted all human efforts further to simplify them, and have hence been denominated elements. Of the great mass of very dense matter which lies far down in the interior we are wholly ignorant.

So far as we have been permitted to observe it, the matter composing the earth consists of three general forms or stages—the solid, the liquid, and the gaseous. The solid crust of unknown thickness is surrounded by a liquid envelope of about eight thousand feet in depth. Owing to irregularities in the surface produced since the solid crust has formed, and due to the contraction of the earth's volume which is still taking place, a considerable amount of the solid matter has been made to rise up out of the water, and this is compensated for by corresponding depressions in the ocean-bed at other places. This condition would naturally occur under the circumstances, and something analogous to it is visible in Mars, and doubtless formerly existed in the moon, but it is not an essential condition of a planet that any dry land shall project above the waters. This is, as it were, accidental, and theoretically the entire surface of the globe is enveloped by a relatively thin film of water some two miles in depth. Surrounding this aqueous envelope is one of gas of unknown depth. Though often put down at fifty or sixty miles, it is certainly much deeper, and meteorites, ignited by contact with it, have been seen at the height of

* A much larger number is now known to exist, but many of the more recently discovered ones are exceedingly rare, and only obtainable by special and delicate processes, while some are still problematical. (See *supra*, p. 162, note.)

nearly one hundred miles. It is known to diminish in density with the distance from the earth at the rate of one centimeter of barometric pressure per hundred meters. Some have supposed that this rate of diminution continued until the atmosphere vanished from its own rarity, but Wollaston * maintained that it possessed a definite surface upon which he conceived the waves to roll much as they do upon the surface of the sea. This view must be sustained unless it can be shown experimentally that there is no limit to the expansibility of a gas. In fact, since the substances of which the atmosphere is composed, though gases, are still as strictly ponderable as water, they must be every-where acted on by the earth's attraction; and, as the air grows more rare in the upper regions and the repulsive force of the molecules diminishes, they must come more and more relatively under the influence of gravitation, and the point must be finally reached at which the latter force will overbalance the former, and render farther removal of the molecules from the earth's surface impossible. Thus would exist a definite limit to the atmosphere.†

Some have thought, perhaps from the analogy of the sun, that the upper strata of the atmosphere may consist of pure hydrogen, extending far beyond the limit of the atmosphere proper. The law of the diffusion of gases would seem to negative this hypothesis, and the fact that the most violent meteorological disturbances never bring us any traces of pure hydrogen is equally unfavorable to it. Moreover, the analogy is not good, since in the sun the heat is too great certainly for the union of oxygen and hydrogen into water or vapor, and doubtless even steam would be decom-

* Wollaston, in the "Philosophical Transactions" for 1822, p. 89.

† The views recently advanced by Professor T. Sterry Hunt, according to which our atmosphere is of cosmical origin, are highly interesting, although they would be regarded as somewhat visionary had they not emanated from so high an authority. (See "Proceedings of the Royal Institution," May 31, 1867, and "Chemical and Geological Essays," second edition, Salem, 1878, p. xii.)

posed there if formed.* The indications are that, as the earth cooled down to the point at which the formation of steam was possible, all the free hydrogen in the atmosphere was seized by the superabundant oxygen and converted into steam, and, as the process of cooling still further progressed, this was condensed to vapor and finally to water, establishing the condition of things which we find to exist.

The atmosphere consists chiefly of four gases, oxygen, nitrogen, carbonic acid, and steam, or gaseous water. Roughly speaking, the relative amount of each of these gases may be stated as follows: nitrogen, 42,000; oxygen, 10,000; carbonic acid, 26; steam, 1. The amount of aqueous vapor, however, is variable, since it is constantly being generated by the sun's rays and again condensed. Still, the average amount existing in the whole atmosphere must remain substantially the same, since the sun always shines on one half the globe and no more. It is probably somewhat greater while the sun is south of the equator than while it is north of it, in consequence of the increased ocean-surface in the southern hemisphere, as well as because at the present time the earth is then nearer to the sun.

The amount of carbonic acid is also somewhat variable in consequence of the facility with which vegetation decomposes, and animal respiration, as well as all forms of combustion, produces it. Still, these agencies are supposed to be every-where somewhat equally balanced. There are certain localities on the globe at which large quantities of this gas are being constantly liberated from beneath the surface where it must have been generated by certain processes not well understood. It is also generally supposed that the vast deposits of coal in the earth are evidence that this gas formerly existed in the atmosphere in far greater proportions than at present, and that it has been extracted from it, and its oxygen liberated, by ages of luxuriant vegetation before the ap-

* Professor Balfour Stewart, address before Section A, at the Bristol meeting of the British Association. Report. London, 1876.

pearance of land animals. Notwithstanding the attempt of Sir Charles Lyell and other uniformitarians to qualify this view,* it has not been successfully disproved. Indeed, it would seem to be a necessary deduction from the data, the only question being as to its sufficiency to produce the "purification" claimed.

It is even more certain that the proportion of oxygen in the atmosphere is gradually diminishing. Its strong affinities for nearly all the other substances have given it a constant career of conquest over them ever since the earth cooled down sufficiently to admit of the formation of solid matter on its surface. It appears to have seized and converted into water all the free hydrogen existing in the former atmosphere. It has combined with all the silicon, aluminum, and calcium lying near the periphery of the forming planet, and thus combined, forms at present about one half of the matter of the crust of the globe. There is reason, however, to believe that this proportion is much less at great depths, and it does not seem probable that a large amount of oxygen is mingled with the molten mass of the interior. This alone would account for the increased specific gravity of the deeper-lying materials. Oxygen also enters largely into all organic compounds, forming more than three fourths of the entire vegetable and animal kingdoms. There still exist many substances to which it has not yet had access, or which there has not yet been time enough to consume, but which are constantly withdrawing the free oxygen from the air and locking it up for ever. Many of the rocks of the earth's surface are constantly adding to their proportions of oxygen. All the carbon existing on or in the earth seems destined to be yet laid under contribution to this tyrant gas. The same is true of the hydrocarbons wherever found, and a heated and lighted city is an example of how man allies himself on the side of oxygen to compass the destruction of every thing which nat-

* Lyell's "Travels in North America," vol. i, chap. vii, p. 119; also, "Principles of Geology," eleventh edition, vol i, p. 226.

ure had seemed to seek to protect from its rapacious grasp. But these breathing human millions still further aid in the devastation, as in their blind ignorance they sacrifice the forests which can alone redeem their losses. It has, therefore, been remarked that long before the heat of the sun shall have so far diminished as to render our globe uninhabitable, the withdrawal of the oxygen from the atmosphere will have gradually asphyxiated all living things.

Great as has been the interest which the world has manifested in oxygen since its discovery by Priestley, and wonderful as its properties indeed are, it can, nevertheless, scarcely be said to exceed nitrogen either in the results which flow from its activities or in the marvel of its manifestations. In many respects these two gases seem to be antithetical in their nature and properties. While oxygen is the embodiment of activity, nitrogen is the embodiment of inertia. Composing four fifths (upward of three fourths by weight) of the atmosphere, it has thus far steadily refused to be incorporated into the solid or liquid parts of the earth. No rock, no mineral, no solid, liquid, or gaseous substance (with the exception of ammonia and nitric acid), belonging to the earth, is a natural compound of nitrogen with any other substance. The nitrogenous beds of Peru are generally supposed to be of organic origin, although the exact nature of the deposits is imperfectly understood. Guano is known to consist of bird-excrement, while the saltpeter of the East Indies is, doubtless, a product of long-lixiviated organic heaps. Ammonia and nitric acid, therefore, are the only compounds of nitrogen known to be formed by inorganic agency. All other nitrogenous products must have first passed through one of these stages; since it is not even given to organized life to form nitrogenous compounds out of free nitrogen. It, too, is compelled to go to ammonia as the only available source of a substance so absolutely indispensable to its existence, and so lavishly diffused throughout the atmosphere.

It may be idle to speculate as to what would have been the result had nitrogen also disdained to form this feeble association with hydrogen, as it does all other associations; and yet to imagine life without ammonia is, in the present state of science, impossible. This persistent refusal to combine with other substances is the special property which gives to nitrogen its great interest to chemistry and importance to biology. Upon this latter point more will be said in its proper place.

As we are now considering the formation of the globe, it becomes an important question what is to be the final destiny of this vast volume of free gas which now so obstinately declines all union with the rest of the earth's matter. We have seen that, as the temperature of the earth declines, the aqueous vapor of the atmosphere will become solid and form part of its crust. The carbonic-acid gas of the atmosphere may be all locked up in peat-bogs and coal-deposits long before that period shall arrive. The oxygen of the air is known to be still grasping at innumerable unappropriated substances, and bearing them down to the earth, and will doubtless be one day wholly reduced to the solid form in permanent combination. But what is to become of this stubborn and inert gas nitrogen, which is gaseous at both high and low temperatures, and shows no disposition to form any combinations with heavier matter? The existence of certain nitrogenous salts in the earth from which nitric acid is derived, especially niter, and the fact that nitric acid is sometimes found in rain-water after a thunder-shower, have been taken to prove that, either by the effect of lightning or in some other manner, the oxygen of the atmosphere sometimes seizes a limited quantity of its nitrogen and brings it down to the earth. Will the conditions ever arise under which this power of combination will be increased? Will any appreciable part of the nitrogen of the atmosphere become oxidized? Such a result seems highly improbable. In nitric acid there are three times as many molecules of oxygen as of nitrogen, while in the atmosphere there is over three times as much nitrogen as oxygen; so that, even if all the oxygen should be consumed in the formation of this compound, a vast quantity of nitrogen would remain free, to constitute all that would be left of the atmosphere. But, whatever becomes of the oxygen, there is reason to believe that a long period of the earth's history will be passed during which its atmosphere will consist of nitrogen alone.

There remains but one other mode in which, in our present knowledge, we are able to account for the absorption of any considerable portion of the nitrogen of the air. Just as a large part of the carbon which plant-life derives from the carbonic-acid gas of the air is stored away in a pure state beyond the reach of oxygen to seize it, and is thus withdrawn from the gaseous and added to the solid portion of the earth, so a large part of the nitrogen which is appropriated by the tissues of living organisms is stored away in the earth in a similar manner. Not only do the extensive niter-beds, guano islands, etc., of the earth testify to this fact, but all "soil" contains this solid nitrogenous matter, and every manure-heap adds to the quantity of nitrogen permanently withdrawn from the air. Still, it would require æons of time to exhaust in all these ways the enormous quantity of nitrogen existing; and it can scarcely be doubted that, long before any such result could be accomplished, the organic era of the earth's history will close, and the last-named process cease altogether.

One concrete fact is of special interest as bearing upon this question. The earth's satellite appears to be wholly destitute of an atmosphere. Now, an atmosphere of pure nitrogen would manifest the phenomena of twilight as well as one composed of two or more gases like our own. If the moon was originally homogeneous with the earth and once formed a part of it, it could scarcely fail to have possessed a similar atmosphere at one period. If so, and that atmosphere has disappeared, it seems probable that ours will disappear in like manner when the earth shall reach the stage corresponding to that at which such disappearance took place in the moon. But we are certain that no temperature has ever yet existed on the moon low enough to cause the solidification of nitrogen, and we must therefore conclude that in the grand processes of cosmical evolution the conditions will be duly developed under which the final aggregation of all kinds of substances can take place. It is the law of evolution which creates the conditions, and not the conditions which permit that law to operate.

The substances forming the fluid and liquid envelopes of the globe are, of course, gaseous and liquid, respectively, at such temperatures as we are most accustomed to. Water or steam becomes a solid at the zero of the Centigrade thermometer, and remains so at all lower temperatures. About the poles of the earth, therefore, it must form a permanent part of the earth's crust, as much so as the rocks do in other regions. It is proved, however, that ice, even at very low temperatures, is constantly undergoing slight evaporation, by which this substance passes directly from the solid to the gaseous state. But all exposed rocks undergo some slight modifications in secular periods, and therefore aqueous rock can not be regarded as any exception.

The carbonic-acid gas of the atmosphere is produced by the action of oxygen in seizing the carbon contained in the earth. This it doubtless effected long before the earth had a crust, and at that early period it is supposed that all carbon existed in this combined state. The various allotropic forms of carbon, such as the diamond, graphite, charcoal, etc., now found in the crust of the earth in the solid state, are probably all of organic origin, the carbon having been appropriated by vegetation from the carbonic acid of the air, and subsequently deposited in the soil and preserved from the contact of oxygen. The cosmical history of carbon is of great interest, and presents many difficulties. Although by no means an abundant substance, it stands next to oxygen and nitrogen in the importance of its results, especially as forming the warp, as it were, of all organic matter. The fact that no degree of heat attainable by man is sufficient to fuse or volatilize it, shows that it must have had its origin at a period when the degree of heat was much greater than any now producible. It was thus safe at its creation from the attacks of oxygen, since the degree of heat would have been sufficient to dissociate all the present compounds formed by that element. It was only as the mass cooled down that carbonic acid was formed, just as was also aqueous vapor; the oxygen and hydrogen of this latter being dissociated, or rather not yet able to associate, at those elevated temperatures. This latter fact is now positively confirmed by the known condition of the sun, the oxygen and hydrogen being there uncombined.

The most abundant substance in the crust of the earth is silica. It is a compound of oxygen with silicon, or silicium, an element never found in an uncombined state. All the sand, sandstone rocks, quartz, and flint of the earth consist chiefly of silica.

Next to silica stands alumina as an abundant constituent of the known parts of the solid earth. It, too, is a compound of oxygen with an element, aluminium, never found in a free state. It is the base of all the clays. Notwithstanding its vast abundance as clay, certain allotropic, crystalline forms of alumina constitute the most brilliant gems of the mineral kingdom. The element, too, which is a true metal, possesses some of the most valuable properties, and is expensive to obtain.

The substance which ranks third in abundance is lime, the oxide of calcium, which, however, usually occurs in the form of a carbonate, that is, combined again with an equivalent of carbonic acid. Of this substance all limestone and marble are composed.

These three substances—silica, alumina, and lime—form the great bulk of the earth's crust, so far as known to us. The two former are of undoubted cosmical origin, but the last is now supposed to be chiefly, if not wholly, of organic origin. It is confined to the sedimentary rocks, and scarcely belongs to our present discussion.

The specific gravity of all these substances is not great; that of the metal aluminium is about 2·6 as compared with water, or nearly the average density of the earth's crust in general. Silicon and calcium are no doubt lighter, although quartz and limestone are heavier than clay. The fact that the earth's crust has this specific gravity is, of course, due to the vast preponderance of these substances in it, and our only means of explaining the far greater specific gravity of the earth taken as a whole is to assume that its interior is composed of entirely different materials having greater density. Deducting the water and a stratum of a few, say twenty, miles for the crust of the globe, the remainder would require to possess about the density of iron (7·5) to fulfill the conditions existing; so that, if there were a very large amount of iron in the earth's interior, there might exist many other substances—some lighter, as magnesium (1·7), sulphur (2), carbon (2 to 3), phosphorus (1·75); and some heavier, as cobalt (8·54), copper (8·89), lead (11·45), silver (10·5), mercury (13·5), gold (19·26), and platinum (21), in such proportions as not materially to alter the general density of the mass. It is, in fact, altogether probable that the greater part of the earth's mass consists of these different metals and substances, of which we find only occasional samples near the surface, imbedded in the stratum of ashes which constitutes the crust. It is also perfectly consonant to all the laws of matter under the influence of gravitation, that, so long as either the gaseous or the liquid state prevailed, the heavier materials should penetrate to points nearer the center of attraction.

If we go back to the period when the degree of heat was sufficient to create and maintain as gases carbon, platinum, etc., we may imagine all the gaseous aggregates of which alone the globe consisted mingled in a promiscuous manner and wholly unable to combine. But even then the lightest gases would doubtless occupy the extreme outer strata, as hydrogen and the gas that gives the green line (*supra*, p. 241) of the spectrum now do in the sun. The degree of expansibility of a substance in passing into the gaseous state is no measure of its density as a solid. In other words, a heavy solid may become a light gas, and *vice versa;* but in a wholly gaseous body the heaviest substances will be nearest the center and the lightest nearest the periphery, and so it will be in a wholly liquid body. If the interior of the earth be not now of a liquid or semi-liquid consistency, not only the interior, but the crust as well, has undoubtedly been so in former times, as the spheroidal form clearly proves. From the wholly gaseous form it has passed by gradual transitions into this wholly liquid form, and in doing so, in consequence of gradual loss of heat, the substances of which it was composed, being of many different kinds and having each a different condensing point, must have passed, one by one, from the gaseous into the liquid state, and as they did so each sought and eventually found its true position in the liquid mass according to its specific gravity, and irrespective of its former position as a gas and of the time, relatively to other substances, at which the change took place. It follows that those substances having the highest condensing-points would condense first, and it so happens that at least one of these, platinum, has a very great density, though in the case of carbon the condensing-point is probably still higher, while its specific gravity is very small. We may imagine a time when the nucleus of the liquid globe consisted of nothing but platinum and carbon. Their mode of association must have resembled that of oil and water, though a much more extreme case.

Thus, gradually, all the elements condensed in a chronological order corresponding to the thermometrical order of their condensing-points, and took up their positions in the liquid mass in the order of their specific gravities. To do this the heavier ones having lower condensing-points must have passed through all the lighter superficial strata. Thus mercury must have sunk through numerous strata of iron, copper, lead, zinc, tin, etc., before finding its appropriate level. When all the gases whose condensing-points are high enough to necessitate their liquefaction before the crust of the globe could be formed, had been thus withdrawn from the atmosphere and added to the globe proper, there were left three gases—oxygen, hydrogen, and nitrogen—to form the gaseous envelope. But no sooner had the point been reached, in the general process of refrigeration, at which it became possible for oxygen and hydrogen to combine, than all the latter gas immediately entered into combination with the former, constituting a compound gas, which was none other than pure steam, to which we might apply the more general and cosmical term *aqueous gas*. This remained in the purely gaseous condition until the process of refrigeration had gone much further, when at length its condensing-point (100 ° Cent.) was reached and it became water, and formed the ocean. This did not take place, however, until after the solid crust of the earth had been formed.

Meanwhile the carbon which had long before been precipitated, and which, in consequence of its small specific gravity, was near the surface, was also seized by the superabundant oxygen and converted into carbonic-acid gas.* Thus the atmosphere and the sea assumed the conditions under which we find them.

The vast volume of oxygen still left in the atmosphere also laid hold of every other substance within its reach. Many of the metals had passed into the liquid state and sunk beneath the molten billows before the conditions for combination existed. Many of these heavier ones, such as

* The fact that all forms of carbon resist oxidation proves that the original formation of carbonic acid must have taken place under wholly different conditions from any now known, perhaps just at the condensing-point of carbon, a temperature too enormously high to be ever artificially produced.

platinum, gold, silver, nickel, lead, etc., oxidize slowly, even under the most favorable conditions, or not at all. These escaped, but all the lighter substances that would combine fell a prey to oxygen. There was a vast quantity of silicium, and this was converted into silex, and now forms half of the earth's crust. The aluminum and calcium, of which immense quantities must also have existed, shared the same fate, and the argillaceous and calcareous rocks were the abundant product. The magnesia, potash, and soda, so extensively distributed over the earth, were the result of the appropriation by oxygen of all that existed of those light metals, magnesium, potassium, and sodium. In its pursuit of the last of these metals, however, oxygen found a formidable rival in chlorine, which succeeded in obtaining enough of it to form all the salt of the sea and of the rocks. But not only the bases of the earths and lighter substances, but also some of the heavier metals, have undergone extensive oxidation. The oxides of iron, copper, lead, manganese, etc., form a large per cent of the crust of the earth. Their occurrence so near the surface, notwithstanding the greater specific gravity of these metals, is due, no doubt, to the fact that throughout the liquid mass of the condensed portion of the globe strong currents constantly existed, and a state of great and violent activity prevailed by means of which substances of less specific gravity were often forced inward and those of greater specific gravity were driven outward; and, while each constituent remained for the most part at or near the position to which its density would naturally assign it, all the substances, regardless of their densities, were liable to be carried away from this position and mingled promiscuously together; so that even gold and platinum, which may form a vast nucleus at the center of the earth, have found their way in small quantities to its surface, and, in a sparing manner, have enabled man to profit by their valuable properties. And yet there may exist other substances, of far greater density than these, of which no trace has ever struggled up through the overlying strata to mingle with the surface materials.

Such is the condition in which we find our planet at the present stage of its development. It consists of a mass of distinct substances or molar aggregates variously combined and related to one another. Of these no less than sixty-five (*supra*, p. 124, note) have thus far resisted all human efforts to simplify them, and are hence called elements. Many others exist as known compounds of these elements, behaving in substantially the same general manner as their simples; so that, unless they had been decomposed and their component parts thoroughly tested, we should have no hesitation in pronouncing them elementary also, and several of them were for a long time so regarded. These known compounds, moreover, exhibit properties of their own not possessed by any of their constituents.

The condition, therefore, of the matter of the earth is one of great heterogeneity. The assumed elements range through an enormous scale with respect to their condensing and solidifying points, as do also the compounds with reference to their combining points. In other respects they present an equal variety and diversity. All this is in strict conformity with the laws of evolution in general, and is really nothing more than the manifestation of these laws in molecular as they are manifested in molar matter. For there is no more reason to doubt that, from the primordial nebulous condition to that which the earth is now in, there should be an advance from the homogeneous to the heterogeneous in the molecular aggregates composing it, than there is to doubt that the present solar system, with its clearly defined sun, planets, and planetary satellites, is an advance in the same direction in the formation of worlds.

It is an interesting fact deserving to be noticed here, in anticipation of more special notice in the next chapter, that the evolution of new and varied aggregates out of few and simple ones requires the assumption of intense heat. The differentiation of such substances as iron, gold, platinum, etc., from simpler states of matter, can not be conceived of in their present solid state, or even in a liquid state. They must be regarded as the products of intensely heated gases, their present state being due to enormous refrigeration. But to say this is simply to say that, in order to produce variety from simplicity, and evolve heterogeneity out of homogeneity, the aggregating tendencies must be powerfully counteracted by the disintegrating tendencies, and progress is the product of the struggle between the two great antagonistic principles in nature. We shall see this law repeated on a higher plane in the production of organic forms.

The history thus far traced is that of inorganic matter. The period during which the existing state of matter has been acquired may be denominated the *inorganic period.* The conflict has been between gases usually at temperatures which the mind would fail to grasp if they could be stated. This period still continues in the sun and in all the self-luminous stars. It is drawing to its close in Jupiter and Saturn. In the earth, and perhaps in Mars and Venus, it has passed by, or nearly so, and been succeeded by what may be called the *organic period.* Cosmical processes, it is true, are still going on on these planets. A few new compounds are being formed; possibly some old ones may be undergoing dissolution; but the great theater of activity at the present time, upon the earth at least, is that of organic evolution.

The earth's satellite, and doubtless many other bodies of the solar system, could they be known, exhibit a third and perhaps final stage of cosmical development, in which, so far as we can judge, organic existence has wholly ceased, and inorganic activity is brought nearly to rest. It is a cold picture, but there seems no escape from the conviction that all the planets and finally the sun itself must reach that stage. What is to be the next, remains wholly unknown. Whether these cold, dense, inactive spheres of solid matter are destined to roll on for ever, or whether they shall be finally brought back by the resistant matter of space to the central body from which they were disengaged, and all eventually redistributed, there is no science as yet capable of affording the slightest indication.

Having thus attempted a general answer to the first of the primary questions of philosophy, "What is matter?" we may now proceed still more briefly to seek an answer to the second fundamental question, "What are relations?"

All properties of matter are due to the mode of its aggregation. The differences in these properties in different substances are the result of the differences of molecular aggregation of each distinct substance. This is very clear in what we know to be compound substances. An example commonly given is that of calomel and corrosive sublimate, two substances possessing very different properties, but known to be formed of the same elements in different proportions. If the substance contain the same number of molecules of chlorine as of mercury, it is an insipid drug; if it contain two of chlorine to one of mercury, it is a virulent poison. But the compounds of nitrogen with oxygen afford equally good illustrations, and others might be enumerated almost indefinitely. Ternary and higher compounds are not less interesting. The different salts differ entirely both from their acids and their bases, and, whatever may be the mode of re-combination, the properties become entirely changed. Every fact which chemistry furnishes on this point is additional evidence that the properties of compound substances result simply from the differences of combination. Every thing, therefore, points to the conclusion that it is in consequence of changes in the mode of molecular aggregation that different substances manifest different properties. Every aggregate has its own kind of activities, due to its molecular constitution. When two are chemically combined, the activities peculiar to the molecular systems of each component, respectively, are broken up and re-compounded, resulting in entirely new activities of the new molecular system of aggregation. We can hardly realize that there is mercury in red precipitate or lead in litharge, so entirely different are their properties. And it is so throughout, wherever there is true chemical combination, *i. e.*, re-formation of molecular aggregates into new systems having new activities.

Our ideas of color have undergone a great change since the undulatory theory of light has taught us to refer different colors to the different powers of substances to absorb waves of different lengths; and we find this so determined by conditions that we are beginning to cease to regard color as a permanent property of matter. But chemistry is unsettling in a similar manner our faith in the permanence of all other properties of matter. Modify the circumstances so that the substance in question may form new associations, and all its properties (except weight) disappear, and new ones are manifested, wholly unlike the original ones.

While these facts may overthrow our time-honored conceptions of matter, they are in perfect harmony with the theory of molecular aggregation here advanced. It is not at all unreasonable to suppose that systems of molecules having different orbits and velocities, and different forces of impact, should manifest to our senses entirely different properties, notwithstanding that we may know that the same molecules are present. Indeed, upon this theory, the properties of matter can not be expected to remain the same except so long as the mode of aggregation remains the same. So far as these properties are concerned, it is the mode of aggregation, and not the identity of substance, which constitutes their essence. Without activities there could be no manifestation of properties, *i. e.*, no properties; and with each change of aggregation must come change of activities, *i. e.*, change of properties.

The facts of isomerism are also in perfect harmony with this theory. In binary and ternary compounds we may conceive of a variety of entirely different substances being formed out of the same elements by changing the proportions of each component. Every time these proportions are changed an entirely different substance is formed, and aggregates of different substances will of course be different. The same may be true of all polymeric isomerides, for no one can know what the mode of aggregation of the components may really be. There are, however, many cases in which chemists believe, and some in which they may be said to know, that they have found the different compound units upon which the differences in the isomerides depend. Butyric acid, for example, is a well-known isomer of acetic ether, whose common symbol is $C_4H_8O_2$. But, if these two isomeric compounds be treated in the same manner by the same reagent (potash), different results follow, which show conclusively that, while acetic ether contains as its component units the two radicals, ethyl, C_2H_5, and acetyl, C_2H_3O, butyric acid is formed of the more complex radical C_4H_7O in combination with free hydrogen, to which it is united by an oxygen-atom in the same manner as are the radicals of acetic ether.*

Many such illustrations might be added, all of which would help to show how perfectly explicable isomerism is when we regard the properties of matter as wholly due to the mode of its aggregation. In fact, such substances do not consist of equal parts of like components. The components themselves, having formed new associations, are no longer the same substances. The resultant molecule is a different system, having a different velocity, path, force of impact, and frequency of contact.

From known compounds we may pass to substances whose composite character has not been demonstrated by actual dismemberment and recombination. These are the so-called "elements." The very fact that more than one such substance is known should be sufficient to raise a sus-

* Josiah P. Cooke, Jr., "The New Chemistry," p. 301.

picion of their composite nature. All that enables us to predicate plurality of them is difference of property. When we say that there are sixty-five known elementary substances, we mean that our senses are affected differently by that number of objects whose manifestations persist, *i. e.*, remain the same every time they are presented, no matter how often the experiment is repeated. If any two manifested precisely the same effects, they would no longer be two but one, "for," as Bacon said, "if a man can make a metal that hath all the properties of gold, let men dispute whether it be gold or no." * But, judging the unknown from the known, applying to substances not known to be compound the law which we have found it possible to formulate in the case of substances known to be compound, viz., that their properties depend altogether upon their mode of combination or aggregation, we find ourselves compelled to assume some mode of aggregation for the former class of substances in order to account for their differences of property. I do not say that we can not conceive of sixty-five distinct qualities of primal matter, but such an assumption certainly belongs to the "violent" class, which are coming to have less and less place in the sciences.

The differences of property manifested by these elementary or irresolvable substances are of precisely the same nature as those manifested by known and resolvable compounds. A piece of copper differs from a piece of zinc in very much the same way that a lump of salt does from a lump of soda. There is nothing distinctive about the differences of elementary bodies by which they may be in themselves known from non-elementary ones. The child, the savage, and the uneducated man never classify on this line, as they certainly would do if there were any such line. All analogy points to the general homogeneity in this respect of all substances. It is true that many of the elements are metals, while no metal has been formed by chemical

* "Silva Silvarum"; also, "Novum Organum," lib. 2, aph. v.

union. But, on the other hand, there are many non-metallic elements, and there are also many at least hypothetical metallic compounds, of which *ammonium* may be named as the type.

Upon the whole, then, the facts themselves, independently of any more comprehensive application of them, preponderate in favor of the composite nature of all material substances, and this is an immense gain for any rational cosmology.*

It might at first be supposed that we have, in the phenomena of allotropism, some direct evidence of the composite character of many of the elements, and I confess that I was at one time of that opinion, but upon more mature consideration I am convinced that such is not the case, and that all cases of allotropism must be explained by the assumption of modifications in the molar, and not in the molecular aggregates. All matter is susceptible of assuming at least three distinct quasi-allotropic forms, the gaseous, liquid, and solid, and there have been observed many intermediate stages. The allotropic forms of phosphorus and sulphur, although differing widely in certain properties, may be produced by simple changes of temperature. Once obtained, however, they persist, notwithstanding such changes. The same is true of carbon. Subject the diamond to intense heat without contact with oxygen, and it is converted into charcoal or a similar coke-like substance. In this latter case we may suppose that the molecules of the diamond are confined within narrower limits than in charcoal, that they have shorter paths and more frequent contacts, and that, moreover, their actions are reduced to greater regularity and defined with greater precision. Such, in fact, is the theory of all crystals as contrasted with amorphous forms of matter. The molar aggregate itself tends to establish a system out of its homogeneous molecules, and this constitutes a crystal.

* Compare the views of Lockyer. Dumas, and Pettenkofer in the "Comptes Rendus" of November 3, 1873.

In amorphous matter this is not the case. But the allotropic forms of sulphur, of silicon, and other elements, although amorphous, must be explained on some such principles. The molecules are differently related in the mass under the different conditions, and this is as well able to produce distinct substances as if the molecules themselves were differently aggregated. It is the effects which they produce upon sensitive parts which constitute differences of property, and the same molecules moving at different rates and with different forces of impact must produce the effect of variety as distinctly as if the molecules themselves were of different degrees of aggregation. The facts of allotropism, therefore, while they afford no evidence that the recognized elements are ever further decomposed, constitute, nevertheless, a new argument for the theory of the properties of matter here advanced, supplementing in an interesting way the arguments from isomerism and from chemical combination in general. But the molecules of the recognized elements are stable aggregates that have resisted the disintegrating influences of the entire cosmical history of our system; they are therefore too firmly fixed for us ever to expect to witness their dismemberment. Of their composite nature, however, we must rest satisfied from the analogy of their properties with those of known compounds, and from those large views of the universe which reach out amid diversity and grasp at unity.

From analysis let us pass to synthesis.

A theory of the origin of matter in the forms under which we know it has already been rudely outlined. We have now only to look at it from the point of view of its properties. Since these are only the sensible effects which matter is able to produce upon living creatures, they are to be explained on the simple principle of impact, which is the essence of the idea of force. When a cannon-ball strikes and shatters a tree, we readily comprehend the cause, but, when a "thunder-bolt" accomplishes the same result, we shake our heads, and say, "Mysterious force!" When strong suction is produced by the creation of a vacuum, we have learned to refer the effect, though the force is wholly invisible, to the air which seeks to fill the vacuum, and "rushes in" for this purpose; but, when we see a body fall to the earth, we say it does so in obedience to the law of gravitation, but humbly and properly avow ourselves ignorant of the nature of that law. Now, the effect produced by the cannon-ball is a case of *molar impact*, and, without going back to the origin of the motion of the ball, is readily understood. The effect produced by the "thunderbolt" is a case of *molecular impact*, and we need not any more go back to the origin of the motion of the molecules to give it an immediate explanation. No matter how they came to acquire it, the fact is that all the molecules of matter in the vicinity of the tree on the side struck were in rapid and violent motion toward the tree, and actually struck it with such force as to shiver it to pieces. There is no difference in the two phenomena, except as to the number and size of the bodies producing the effect.*

In the case of the vacuum, the hand interposed in the current simply experiences the impact of millions of molecules of oxygen, nitrogen, etc. The effects of a strong wind are identical with this in all respects, and wind is always actually caused by air rushing into a partial vacuum.

Now, when a body falls to the earth, shall we say that it is due to any other cause than that which would, were the wind sufficiently strong, carry the same body in a direction perpendicular to that in which gravitation acts? Is its fall not also due to impact of molecules or atoms which are pelting it with greater force on the upper than on the under side? If all matter, in whatever state of aggregation, has always been in motion, which motion, therefore, need not

* Cooke, "The New Chemistry," p. 44; also, Professor Clerk Maxwell's "Address before the British Association at Bradford," in "Popular Science Monthly," vol. iv, p. 279.

be explained, then all that remains to be explained in gravitation is why it operates in the particular directions in which we observe it to operate. Of this we are still ignorant, just as man was ignorant of the reasons why the molecules of the atmosphere took the directions which they were observed to take when it was said that "the wind bloweth where it listeth." The laws of meteorology were as absolutely unknown then as are those of barology now. As all force must be referred to molecular impact, so must all other so-called properties of matter, force, or molecular impact, being simply the generic property under which all effects of whatever kind are embraced. A substance, could such a one be conceived, which should consist solely of ultimate atoms of matter, could possess very few properties. Feeble resistance is about all that could be expected of such a substance. The first degrees of aggregation from that consisting of the simple cohesion of two atoms and their revolution about their common center of gravity, or whatever might be the mode of their aggregation and activities, to those in which the units of aggregation should consist of aggregates of the third, fourth, or even tenth order, would perhaps still remain imperceptible to any being endowed with feeling. The molecules of such aggregates would be too minute, their momentum too slight, their impact too faint, to produce any effect on the large multiply-compound units that compose the sensitive nerve-tissues of animals. The ethereal medium that conveys light through space is undoubtedly the lowest aggregate of whose presence sentient beings are rendered cognizant. Its molecules are so much more minute than those of any of the so-called "ponderable" substances that they appear to be independent of the law of gravitation. They penetrate bodily and with perfect ease the humors of the eye, and are felt by the exceedingly delicate nerve-tissue that is spread out over its interior surface. This mechanism is a comparatively recent development of organic nature, and, notwithstanding all that science has said about it, its extreme delicacy is not yet fully appreciated, and will not be until it is generally realized to the influence of what a remarkable *medium* it alone, of all the nerve-tissues, is susceptible and sensible. It is only since the invention of photography that it has been generally known that light exerts any other influence upon terrestrial things.

Delicate as is the mechanism of the ear, it is sensible only to the impact of the comparatively heavy and normally material molecules of the air; and the odorous particles that emanate from bodies, and manifest their presence on contact with the olfactory nerves, belong to the more complex, chiefly organic matters, and prodnce their effects principally by the inherent activities of the molecules themselves.

Besides the ethereal medium, no other aggregates are appreciable by the nerves of sense except such as are known to obey the laws of gravitation. These are the elements of chemistry and their compounds. Most of these, too, would be imperceptible in the gaseous state, *i. e.*, if we depended upon the activities of the molecules separately to furnish us our knowledge of their presence and existence. It is usually only as molar aggregates, in which many molecules cohere into a mass, that we are able to detect them, though many such, when once detected in the solid or liquid state, may be made perceptible in the gaseous state. Besides the sixty-five recognized elements, there exist, as combinations of these in different ways, thousands of distinct substances, manifesting an almost infinite variety of properties.

To explain in a purely theoretical manner the conditions necessary to produce so many distinct elementary substances, we must suppose that they are all highly compound, and consist of molecules of different degrees of aggregation. Their atomic weights, as proved by their modes of combination, indicate that they are of different sizes, weights, etc. A great variety in the mode of aggregation is possible. Suppose the units in the hydrogen molecule to consist of aggregates of the fifth or sixth order or of both, a definite number of each kind of unit in each molecule, and these to move in regular, definite orbits, or paths, in a molecular system. Then we may suppose that the oxygen molecule, which has sixteen times the mass of the hydrogen molecule, consists of aggregates of the tenth or twelfth order, or of these and others of still higher orders, or of several kinds of orders, both higher and lower, aggregated into a large system, each of the units having its own definite motions, and each molecule having the same fixed number of each kind of units, whose combined activities should be sufficient to give to oxygen all those properties with which we find it endowed. Thus may be hypothetically explained the constitution and properties of all the elementary substances. Of course, the molar aggregates of each, formed by the cohesion into a solid, liquid, or gaseous mass of many such like molecules, would possess properties derived from those of their constituent molecules, though differing greatly in different states. These properties, though the necessary consequence of the mode of aggregation of the different molecules composing the compound, would not on this account resemble those of any one of their components. Properties, being simply the subjective manifestation of the objective fact of a certain mode of impact, might bear no sort of resemblance to one another, although the mode of impact were the exact mechanical resultant of the combined impacts of constituents having such different properties. Take any known compound, as carbonic oxide. This has properties very different from those of either oxygen or carbon; and yet the activities which are the objective cause of its manifestations must be the exact mechanical resultant of the combined activities of these two substances. In other words, there is no fixed relation between the differences in the objective activities and the subjective manifestations. Slight differences of the former kind may produce great differences of the latter. The addition of a small unit to a large system may entirely alter its mode of manifestation to sense, and even a slight change in the grouping of identical units may produce a new substance, as the phenomena of isomerism render quite certain. This point, however, need not be dwelt upon, since it is really none other than the scientific version of the old question of the relation of the external world to the mind, with regard to which, in whatever respects philosophers may have differed, all have at least agreed that it is not a fixed proportion, and that, if the one is a true function of the other, it is a function for the determination of which we have as yet no formula.

The recognized elementary substances, presenting so many different qualities, vary greatly in their so-called "atomic weights." This means simply that their molecules vary greatly in mass. The hydrogen molecule is the smallest known, and is hence taken as the standard. Compared with this as unity, we find that the molecule of oxygen contains 16 times as much matter. Its chemical equivalent is therefore said to be 16. That of carbon is 12, that of nitrogen 14, while that of chlorine is 35½. But these, instead of representing large equivalents, are, when compared with those of most of the metals, very small. One molecule of mercury contains 200 times as much matter as one of hydrogen, and one of gold 197 times as much. The combining number for platinum is given at 197·4, that for silver at 108, for antimony at 120·3, for bismuth, 208, and that for lead at 207, while the thorium equivalent has latterly been quadrupled and put at 231·4, being the largest of all the elementary units. The equivalents of sodium (23) and potassium (39·1) are smaller, as also are those of the non-metallic elements in general, as phosphorus (31), sulphur (32), and silicon (28).

Whether hydrogen, carbon, nitrogen, oxygen, or any of the other abundant elements having small molecules, ever enter into the composition of the elements having large molecules, is a legitimate question for those chemists to discuss who are not satisfied with the idea that such substances are absolutely elementary. Although not at all necessary to the theory of matter under discussion, it would at least seem probable that such was the case. The fact that these molecules are stable, whether combined or uncombined, is favorable to this view, although there may exist as component aggregates of metallic molecules many equally stable aggregates which no human power can dissociate from their present combinations. But, if known elements were employed as components of other known elements having larger molecules, the very fact that they are elements, *i. e.*, that we are unable to decompose them, would render it impossible to know that they had other elements for their components. Think how many hydrogen, oxygen, or nitrogen molecules might enter into the system that constitutes the molecule of bismuth or of gold!

It is a remarkable fact that those elements which have very high condensing-points, *i. e.*, which assume the liquid (or solid) form at very high temperatures, have large combining numbers, *i. e.*, large molecules, while those having low condensing-points, and which are gaseous at ordinary temperatures, as a rule have small combining numbers, or small molecules. To this, carbon and mercury form notable exceptions, it is true, and prove that it is according to no uniform law; but, nevertheless, the bulk of the facts support this statement, and indicate that the genesis of those elements which we know only as solids or liquids, which we have supposed to have taken place during the fiery ordeal through which the solar system has had to pass, is rather a process of integration than of disintegration; since they have much larger molecules than the gases that exist in the nebulæ.*

* The recent investigations of Professor J. Norman Lockyer, which have led him to conclusions not widely differing from those here expressed, were not published until after this chapter was written. While it would be improper to pass unnoticed such important researches into the essential conditions of the universe, yet, from the substantial harmony of the theory proposed in this chapter

The power of the elements to affect the senses is small compared with that of many compound substances. Few of the gases are perceptible to any of the senses, and affect the

with the facts and results brought out by them, it is quite unnecessary to recast the former. There is, however, one important point respecting which opinions might at first sight differ, but which, when properly viewed, really constitutes a striking confirmation of the theory by the facts. One of Professor Lockyer's most important generalizations is that "the running down of temperature in a mass of matter which is eventually to form a star is accompanied by a gradually increasing complexity of chemical forms."

Certain of the facts by which he illustrates this law he condenses into the following tabular form:

$$\left.\begin{array}{l}\text{Hottest stars}\\ \text{Sun}\\ \text{Cooler stars}\end{array}\right\}\text{ show lines of }\left\{\begin{array}{l}H + Ca + Mg.\\ H + Ca + Mg + Na + Fe.\\ —\quad —\quad Mg + Na + Fe + Bi + Hg.\end{array}\right.$$

$$\text{Coolest stars, fluted bands of}\quad — \; — \; — \; — \; — \; — \left\{\begin{array}{l}\text{Fluted spectra of}\\ \text{metals and met-}\\ \text{alloids.}\end{array}\right.$$

Without at all changing the character of this exhibit, it may be put in a slightly different form, as follows:

$$\overbrace{\overbrace{\overbrace{\underset{1}{\overset{1}{H}} + \underset{12}{\overset{24}{Mg}} + \underset{20}{\overset{40}{Ca}}}^{\text{Hottest stars.}} + \underset{23}{\overset{23}{Na}} + \underset{28}{\overset{56}{Fe}}}^{\text{Sun.}} + \underset{100}{\overset{200}{Hg}} + \underset{208}{\overset{208}{Bi}}}^{\text{Cooler stars.}}$$

In this diagram calcium and magnesium are transposed, but, as both are revealed by the spectra of the hottest stars, this change does not affect the order of the groups. The same is the case with bismuth and mercury, both belonging only to the cooler stars. The figures placed above the symbols are those representing their atomic weights according to the new system, and those placed below them their equivalents according to the old system. It will be seen that, with the exceptions of calcium and sodium, the new equivalents form a continuous ascending series, while, with the old equivalents, not even this break occurs in the series, the equivalent of calcium having been doubled, while that of sodium has remained unchanged.

On the theory advanced in this chapter, of the successive evolution of the various elements and their formation out of the simpler aggregates existing at the period of their creation, it would certainly be in the cooler because *younger* stars that the fewest and simplest elements would be expected, growing fewer animal system only when inhaled. Liquids and solids have more decided properties, but with the exception of arsenic and a few others all the elements are rather inert. This may be due to the smallness of their molecules, or, more properly speaking, to the simplicity of the systems forming such molecules. The larger and more complex such systems, the more varied and active will be the properties manifested.

Passing from substances whose composition is unknown (elements) to those whose composition is known, we find that, of inorganic compounds, those possessing the most decided properties are the acids, alkalies, and salts. Looking at their combining numbers we find them large. Carbonic acid, which is among the lowest and most inert, and is not an acid at all in the modern sense of the term, but a binary compound, has molecules 44 times those of hydrogen. The common-salt molecule is equal to 59 hydrogen molecules, that of the carbonate of soda to 106, and that of Rochelle salt to 438, while that of alum foots up 517.

The organic compounds are all of high degrees of organization, and have large complex molecules. The equivalent of morphine ($C_{17}H_{19}NO_3$) would be 285, that of strychnine ($C_{21}H_{22}N_2O_2$) is 334, and that of quinine ($C_{20}H_{24}N_2O_2$), 324. A molecule of sugar weighs 342 microcriths, and one of starch 324. And thus it is throughout the organic compounds.

In the albuminous group the size and complexity of the molecules are still greater, so much so that no reliable formulas of any of them have yet been obtained. From such approximations as have been made, however, it would seem that a molecule of albumen weighs nearly 5,000 times as much as

and simpler until the nebulæ themselves are reached, while the hotter stars should yield the richest abundance of elements as well as those having the most complicated structure, *i. e.*, the largest molecules. The assumption, apparently favored by Professor Lockyer and freely made by others, that the cooler stars and the sun have lost a portion of their heat formerly possessed, is wholly gratuitous, and has already been sufficiently combated. (See also "Popular Science Monthly," vol. xviii, p. 538.)

one of hydrogen, while one of blood-fibrin or of casein would weigh 5,000 or 6,000 times as much.

These examples are sufficient to show that in order to come up to working proportions the degree of aggregation must be high, and the molecules of substances capable of appealing to sense and generating organic beings must be large as compared with those of the elements which combine to produce them. In other words, while out of substances possessing very small molecular aggregates vast molar aggregates may be formed by simple multiplication and accumulation, and the whole inorganic world, the rocks, the mountains, nay, the very orbs of space, may be created, yet, for the development of organized beings, whether animal or vegetable, a different class of substances is required, substances contrasting with the former by the larger size and greater complexity of their molecular aggregates, by greater instability and *more active properties.*

These preliminary considerations respecting the origin and nature of matter in general will better prepare us to enter upon the discussion of the questions to which the presence of life on our globe gives rise, and which the reader is asked to regard rather as a continuation of the present inquiry into the nature and properties of matter than as in any sense a distinct subject. There are no breaks in the processes of nature, and the aim of all true philosophy is to establish the continuity which the philosopher is confident must exist throughout all its departments.

CHAPTER IV.

SECONDARY AGGREGATION.

BIOGENY *—GENESIS OF ORGANIC FORMS—VITAL RELATIONS.

Dependence of the properties of matter upon their mode of molecular aggregation—Reciprocal increase of mass and decrease of stability of molecules during the processes of cosmic and organic evolution—Initial step in the development of life—Formation of the organic compounds—Isomerism—History, origin, and constitution of protoplasm—Plasson bodies—Reciprocal relations of organization and life—Nutrition and reproduction—Morphological units—Chemical *vs.* morphological organization—Moners—The sea the common mother of all life—True vital phenomena confined to the activities of protoplasm—Organization a means of intensifying the effect of protoplasmic activities—Origin of the cell—Orders of individuality—Living distinguished from non-living bodies—Nature of growth—Nature of reproduction—Theory of sexual differentiation—Animals distinguished from plants—Development of the organic out of the inorganic—Organic aggregation—Simplest form of tissue—The stomach the first organ formed—Embryogeny—Ontogenesis a recapitulation of phylogenesis—Nature and functions of chlorophyl—Fibro-vascular bundles—First appearance of leaves—Carbon the framing timber of organic beings—Power of protoplasm to decompose carbonic acid—Influence of light on plant-growth—Classification of organisms with respect to their power to manufacture organic substances—Proper meaning of spontaneous generation—Respiration common to plants and animals—The two forms of nutrition in plants—Constitution and function of muscle—Constitution and function of nerves—Fundamental nature of organization.

We have seen that matter, in its cosmical history as enacted in the development of a planetary system, assumes a great variety of forms, and resolves itself into numerous

* "Biogenia (Griechisch) = Entwickelungsgeschichte der Organismen oder der lebendigen Naturkörper im weitesten Sinne! (*Geneā tu biu*)."—(Haeckel, "Anthropogenie," S. 710, note to S. 6.)

specifically distinct aggregates. The different substances which we know on our planet are the result of the cohesion into homogeneous masses of these different aggregates, all the constituent units of any one of these masses consisting of the same *species* of molecular aggregate. The properties of the masses, therefore, depend absolutely upon the nature, *i. e.*, the mode of composition, of their molecular units, although our knowledge of these is wholly insufficient to enable us to predict the properties of any compound to be formed out of known substances.

We saw reason to suppose that at an early period in the development of the solar system (and we may infer the same for all systems) the number of distinct substances was small, and that these substances were gaseous at very low temperatures. The two abundant gases, nitrogen and hydrogen, exist in the irresolvable gaseous nebulæ, and doubtless went far to constitute the original substance of our infant system. These substances, though differing greatly from one another in that respect, have nevertheless small molecular aggregates as compared with those of most substances now found in the earth, and which are mostly solid or liquid at life-supporting temperatures. There has, therefore, been upon the whole *increase of mass* among the molecules of substances later developed.

When we rise to the point of view which removes all distinction between "elements" and "compounds," except the subjective one that in the former we do not know and can not prove empirically their state of composition, while in the latter we can do this in so far as to resolve them into the former, we can make the further general statement that not only do these known compounds sustain the above-mentioned law of the progressive increase of mass of the molecules of matter, but that there is also progressive *decrease of stability* in such molecules. We are, of course, unable to predicate this of such substances as we are unable to decompose, although they doubtless vary greatly in their relative stability, and, as before remarked, some substances which had been supposed to be elementary have already yielded to human efforts to separate them, and others may still do so. Moreover, those that have thus yielded possess large molecules, and this should serve as an index for future attempts of a like nature. There is, for example, little hope of artificially resolving hydrogen or carbon into simpler elements, but the reverse of the alchemists' dream may yet be realized, and gold be reduced, if not to baser at least to simpler molecular elements.

All known chemical compounds must be supposed to have been developed within relatively quite recent periods. The intense heat that has prevailed throughout the greater part of the history of the solar system, and which indeed still prevails in its nucleus, the sun, which is $99\frac{6}{7}$ (vol. i, p. 260 and note) per cent of the entire mass of the system, or nearly the whole of it, has prevented the formation of any of the substances which we know to be composite. It is only in the comparatively small masses which have been accidentally separated from the rest, and which in consequence of their diminutive size have sooner reached the stage at which the radiation exceeds the generation of heat, that conditions have been produced under which such comparatively unstable substances as water, carbonic acid, and the oxides composing the earth's crust, could exist. The formation of such substances may, perhaps, be regarded as the first step toward the development of life on the globe.

In proportion as the degree of heat diminished, the capacity for more and more unstable substances increased. The earliest compounds were those in which silicon, potassium, sodium, magnesium, etc., combine with oxygen, several of which were, from their great stability, long regarded as elementary. Then came a variety of acids, alkalies, and salts, together with compounds of the metals. These the early alchemists succeeded in resolving, and the ores of the metals were many of them successfully worked by the ancients.

Later, as the temperature still further lowered, the oxygen was enabled to seize the hydrogen and form the gaseous protoxide steam, or aqueous gas, which, at a still later period, when the temperature of the earth's surface fell below 100° Cent., condensed into water. Long prior to this, carbonic acid had been formed, and doubtless constituted at that time fully one half the gaseous atmosphere of the earth. The vast amount of free carbon now existing in the earth, and still more that which is fixed in the chalk and limestone formations, all of which must have formerly existed in the atmosphere in the form of carbonic-acid gas, indicates that the above estimate is probably far too low.

All the compounds thus far referred to and all others having a certain degree of stability must have been first formed at a period of considerable heat, the dissociation-point of all compounds having been estimated at 6,000° Cent., although this doubtless varies for different compounds as greatly as do the condensing-points of different gases.

But there are many compounds which are continually forming at such temperatures as now prevail at the surface of the earth, and most of these are very much more unstable than those last mentioned. The elements which chiefly enter into these compounds are oxygen, nitrogen, hydrogen, and carbon, all but the last named of which are gaseous at ordinary temperatures. The substances of this nature with which we are familiar are known as "organic compounds," and such as we commonly see are in fact the products of organized beings from the different parts of which they are obtained. That such substances, however, are formed by nature directly out of the inorganic world can not be doubted, although so unstable are they that, unless held together by some special force, they must succumb almost as soon as formed, and therefore never leave any evidence of their existence.

Quantitative chemistry has not only succeeded in the complete analysis of all the substances of this nature obtained from organized beings, but it has also effected the synthesis, or reproduction out of the inorganic elements, of a large number of them. All these substances have their peculiar properties depending on their molecular constitution, and the glycerine which is manufactured in the laboratory possesses the same sweet taste as when obtained from organic sources. Some of these substances are exceedingly complex, and consist of molecules of a very high order. We have already (*supra*, p. 298) referred to some of these, and shown that their molecules often contain several thousand times as much matter as a molecule of hydrogen. Their instability, moreover, bears some proportion to their complexity.

Most of these compounds are colloidal and refuse to crystallize. Some of the simpler ones, however, in which the proportion of oxygen is large, as sugar, for example, become crystalline under certain conditions. The only element which is never absent from any of these compounds is carbon. Oxygen is almost universally present, and the "hydrocarbon" group in which it is wanting is quite distinct from all others. Hydrogen comes next in point of regularity, and these three elements make up the great bulk of all organic matter, and a large number of them consist of these three alone, which, by altering the proportions, are capable of producing an almost unlimited variety of bodies all possessing different properties. When nitrogen is added, a marked change is made in the nature of the compounds. The nitrogenous group is distinguished especially by its great instability, and also by the number of isomeric forms which these compounds are capable of assuming. The only other elements that enter to any great extent into organic compounds are sulphur and phosphorus. These occur in limited but definite proportions in many of the most complex substances.

The remarkable contrasts which the elements constituting the organic compounds present when compared with one another have been frequently pointed out by different writers, and they are certainly adequate to explain most of the properties possessed by these bodies. The chief characteristic of oxygen is its great chemical activity, or tendency to combine with other substances, while that of nitrogen is its inertia, or inability so to combine. Carbon is a solid at all temperatures producible on the globe, while all the other three chief constituents of organic matter are practically incapable of solidification. This fact is a measure of the degree of cohesion of the homogeneous molecules composing the respective molar aggregates; that of carbon is intense, while that of hydrogen is exceedingly slight. While this in each case depends on the degree of heat, it will be relatively the same among them all at any given temperature.

It seems probable that all attempts, so to speak, on the part of nature to form compounds of the gaseous elements alone have resulted, if successful, in substances which are at once pronounced inorganic, such as water (H_2O), ammonia (NH_3), nitric acid (HNO_3), etc. It is remarkable that, while the chief compound of the two persistent gases, hydrogen and oxygen, is liquid or solid at our temperatures, that formed of the persistent solid, carbon, and oxygen (CO_2), is a gas at ordinary temperatures and pressures. Notwithstanding this, it can not be doubted that carbon is the agent which, by its great molecular cohesion, prevents the dissolution of the higher compounds, and renders organic substances possible.

The transition from the inorganic to the organic is purely nominal, and the existence of any definite line marking off one of these fields from the other has long been denied. If there were any advantage to be derived from such a line, perhaps it could not be drawn in a better place than where carbon unites with hydrogen or nitrogen, either with or without oxygen. This would place all the hydrocarbons in the organic series, as also cyanogen, which can only be obtained by the use of organic matter.

The inorganic compound, therefore, nearest related to the organic series would be carbonic acid, of whose inorganic origin there can be no doubt. The simplest organic compounds consist chiefly in the addition of different proportions of hydrogen to this basis and the reduction of the proportion of oxygen. In the various hydrides (methylic CH_4, ethylic C_2H_6, amylic C_5H_{12}, etc.) the oxygen disappears altogether. In the alcohols it reappears only in the addition of one oxygen molecule to the respective hydrides. The acids result from an additional increase in the proportion of oxygen. Formic acid is written CH_2O_2, acetic acid $C_2H_4O_2$, etc. The actual development of organic compounds, as it may be supposed to take place in nature, would seem to be in the reverse order to that above given, the acids being first formed, then the alcohols, and lastly the hydrides, thus:

$$\underset{\text{Carbonic dioxide.}}{CO_2}+H_2=\underset{\text{Formic acid.}}{CH_2O_2}\,;\; CH_2O_2+H_2-O=\underset{\text{Methylic alcohol.}}{CH_4O}\,;$$

$$CH_4O-O=\overset{\text{Methyl.}}{CH_4}, \text{ etc.}$$

This example involves the simplest known organic compounds, and sufficiently illustrates how the formation of them all may be conceived to take place in nature.

In the formation of sugar ($C_{12}H_{22}O_{11}$), starch ($C_{12}H_{20}O_{10}$), gum ($C_{12}H_{20}O_{13}$), etc., the proportion of oxygen is quite large, and the phenomenon of crystallization occurs under certain conditions. The oils are a more complex group, being formed by the union of very feeble acids with the common base glycerine ($C_3H_8O_3$). They are colloid under all conditions, and decompose much more easily than the amyloids.

The most important organic compounds, however, especially from the biological point of view, are those containing nitrogen. These fall under two general classes, and constitute the so-called *organic bases* on the one hand, and the *albuminoids* on the other. The former of these groups have been for the most part extracted from vegetables, of which they constitute the "active principles," or characteristic properties. As illustrations of the nature and composition of these substances, we may mention morphine ($C_{17}H_{19}NO_3$), narcotine ($C_{22}H_{23}NO_7$), quinine ($C_{20}H_{24}N_2O_2$), strychnine

($C_{21}H_{22}N_2O_2$). It will be seen that the principal particulars in which these fundamentally differ from the organic compounds already considered consist in the addition of a small percentage of nitrogen and the reduction of the proportion of oxygen, yet the properties which they possess are a hundred-fold more active.

The composition of the organic bases, however, though somewhat complex, is simple compared with that of the albuminous compounds. These contain, in addition to the elements of the former, small but rather definite proportions of both sulphur and phosphorus. The number of molecules of each of the components indicates a large complex molecule. That of albumen, could the formula of Liebig ($C_{216}H_{338}N_{54}S_3O_{68}$) be relied upon, contains 679 equivalents, and is 4,870 times as large as one of hydrogen, while that of fibrin is said to be still larger. The substances thus composed, as we should naturally expect, are very unstable, and possess remarkable properties. They constitute the substance of the muscles and nerves of the animal system and the fibrin of blood. They are also found in a peculiar form in all cells, whether animal or vegetable. The base of the entire group is known as *protein*, so named from its remarkable power of assuming different isomeric forms, of which it presents some thousand or more. Protein contains no sulphur or phosphorus, and its formula, as given by its illustrious discoverer, Mulder, is $C_{18}H_{27}N_4O_6$. Each of its units, therefore, is composed of 65 elementary molecules, the combined mass of which is equal to 395 molecules of hydrogen.

This substance, it is proper to state, is to some extent theoretical, and is not believed in as a reality by many chemists, while all the albuminoids are often indiscriminately denominated protein bodies. All the actual known substances of this group have, as we have seen, much more complex molecules still.

The high order of composition of these bodies is the sufficient explanation of the facility with which they assume isomeric forms. Among many of the subordinate aggregates entering into an albuminoid molecule, the elective affinities are so nearly balanced that any slight disturbance is sufficient to break up some of the combinations and produce new ones. For example, under one form there may be supposed to exist carbonic-acid molecules and ammonia molecules, together with free molecules of all the elements forming these units, but by some shock, change of temperature or condition, or from any other cause, part or all of these compound units may be decomposed, and the elements composing them be set free. These will either remain free and cohere with like molecules or they will re-combine metathetically with one another into different forms. In either case a new substance with distinct properties is the result. The number of water-molecules may thus vary to any extent, changing the character of the compound with each new variation.

Mr. Herbert Spencer has very ingeniously explained the nature not only of muscular contractility, but also of nervous discharge on this principle, and maintains that the substance of the muscle and nerve takes on a new isomeric form, with only slight loss of matter at each contraction, sensation, or motor impulse.*

Apart from the living organism, all the substances thus far mentioned possess sufficient stability to be retained, handled, and examined, and to the ordinary observer they present very much the general appearance of other matter. Although possessing many special qualities distinguishing them from other bodies, the albuminoids, as well as all the other organic compounds, appear to be and are incapable of any visible automatic movement. Like other solids, however, even the densest crystals or metals, we are obliged to suppose that these also possess at all times molecular activities. It is these, as we believe, that determine the respective properties of all substances, and constitute the multiple and varied in

* "Biology," vol. ii, § 302; "Psychology," vol. i, § 9.

nature. In protein bodies we must suppose that these molecular activities are much more extensive and varied than are those of ordinary inorganic bodies. The molecular units are so much larger that their motions must be, as it were, *molar* in comparison, while within these larger primary units there are lesser units of many different orders of aggregation, each of which manifests its own appropriate activities, and thus modifies the general properties of the whole. The reason we are unable to see these motions is simply that they are on too small a scale, and vast as is a protein molecule compared with inorganic molecules in general, it is still far too minute to permit the human eye to perceive any molecular changes that are going on within a mass of this substance.

There is much evidence that living organisms are not made up simply of organic matter specially arranged. The various organic compounds, as before remarked, must perhaps be wholly accounted for as derived originally from organisms, from whose bodies, living or dead, they were taken, either ready formed or in such form as was able to yield them by the application of certain processes. Afterward, when chemists had learned of what inorganic elements they were composed, they succeeded in producing many of them directly by compelling the proper combination of these elements. But all the substances within the living body which properly belong to this class are obviously no longer of active service to the organism. They are either effete, reserve, or skeleton matters, whose functions have either wholly ceased or are of a mechanical character. Of this nature are urea, fat, woody tissue, etc. The same is true of the whites of eggs and the so-called "albumen" of seeds. Where they are products of the tissues they are formed by breaking up the normal composition of these and extracting the organic compounds from them. In either case the organic compound represents a simplification of the organized tissue. The effete matters, fatty deposits, and other organic products of living organisms appear to be degraded bodies possessing something less, both of vital and chemical organization, than the true living tissues themselves. And this is doubtless the literal fact.

The development of the albuminoids, highly complex as they are, is not alone sufficient for the immediate genesis of life. A form of matter still more complex must be reached before this result is possible. But there is no evidence that this form of matter is produced by any different process from that by which all other forms of matter are produced. From the hypothetical molecule of the first order produced by the union of ultimate atoms to the molecule of hydrogen or other recognized element, and from this to the molecule of albumen or fibrin, the process has been uniformly the same, that of successive compounding, re-compounding, doubly and multiply compounding. In short, it has been the process of molecular aggregation. It would be contrary to the law of uniformity known to prevail every-where in nature where experience has been able to reveal it, should there be found an abrupt change of process at this point. Upon those who assert such a *saltus* must rest the burden of proof, and no proof has yet been adduced. We are all the way dealing with molecules, and are able to judge only by the effects. But we observe that, without changing the elementary substances which analysis can demonstrate to be present at any stage of the process, with each new step in the progress of aggregation new and higher properties are created. From the inert properties of carbon and nitrogen in the free state, of water and carbonic acid, the simplest compounds, we have, by further successive compounding, the more active ones of ammonia and nitric acid, the sweet taste of sugar and glycerine, the powerful narcotic properties of narcotine and morphine, the deadly toxic properties of strychnine, and, manifesting themselves in a wholly different manner, the still higher order of properties, including those of isomerism, exhibited by the protein bodies; all of which we seem bound to ascribe to the respective orders of combination and complication under which these substances, possessing the same elementary constituents, exist, when they display these qualities which are the effects of their molecular constitution. With still higher states of aggregation we would, therefore, expect still higher forms of activity, still more marked properties.

We have also learned that, while we may safely predict higher properties from higher degrees of aggregation, we have no basis whatever upon which to predict the nature of this change. Not even in the simplest inorganic re-agencies can we foretell the result of the union of any two elements. We can not even tell which of the three states, gaseous, liquid, or solid, our new compound will exhibit at our temperatures. The invincible solid, carbon, when joined with oxygen becomes a gas; the type of all gases, hydrogen, when combined with another gas (oxygen), results in a solid at 32° Fahr. Much less can we predict the other more special properties even of these primary compounds. *A fortiori* is human prevision wholly inadequate to presage the result of organic combinations. That the re-compounding of the protein bodies should result in a new form, possessing the quality of spontaneous movement, is *a priori* just as probable (and no more so) as that the addition of a molecule of oxygen should convert the hydrides into alcohols.

This complex stage of aggregation is no longer an hypothetical one. The molar aggregate resulting from such a re-compounding of the albuminoids has been discovered. It exists under diverse conditions, and manifests properties fully in keeping with its exalted molecular character. This substance, discovered by Oken in 1809 and denominated *Urschleim*, recognized by Dujardin in 1835 and called *sarcode*, and thoroughly studied by Mohl in 1846, who named it *protoplasm*, has now passed unchallenged into the nomenclature of modern organic chemistry under the last-mentioned title.

Protoplasm is a real substance, found in considerable abundance in nature, not only within the tissues of organized beings, but, as we might almost say, in a mineral state, wholly disconnected from such beings. There is no more doubt that it is elaborated out of the inorganic elements than there is that ammonia or common salt is thus elaborated. It is a true chemical compound, in which the proportions of each element are known. It contains approximately 54 parts of carbon, 21 parts of oxygen, 16 parts of nitrogen, 7 parts of hydrogen, and 2 parts of sulphur, in 100 parts.*

These proportions doubtless vary somewhat, but suffice to represent this body from this point of view. To write its chemical formula is impossible in the present state of science. The formulas given for the albuminoids are merely theoretical and conjectural. Their numerous isomeric forms show us that the grouping of the molecules is subject to constant changes. This is doubtless true to a far greater extent of protoplasm. It is a substance whose molecular units are probably compounds of the units of the albuminoids. These enter bodily into them in the same manner that oxygen and hydrogen enter into water, or as we suppose ammonia, carbonic acid, and the compound radicals to enter into the more complex organic compounds.

The final molecular units of protoplasm seem to be identical with Herbert Spencer's "physiological units." He says ("Biology," I, § 66): "There seems no alternative but to suppose that the chemical units combine into units immensely more complex than themselves, complex as they are; and that in each organism the physiological units, produced by this further compounding of highly compound atoms, have a more or less distinctive character." And again (letter to the editor of the "North American Review"): "Organic evolution takes place only on condition that *the masses of protoplasm, formed of the physiological*

* Professor Ernst Haeckel, in "American Cyclopedia," article "Protoplasm."

units, and of the assimilable materials out of which others like themselves are to be multiplied, are subject to heat of a given degree."

Nor is it wholly inconsistent with the present theory to carry the notion of these physiological units to the extent of supposing that they are so varied in kind as to require a distinct species of unit to secure the development of each species of organism, although this doctrine is not without serious objections, and the discussion of the theory of pangenesis is beyond the scope of this work. It should, however, at least be remarked that, as there are various kinds of albuminoid substances having somewhat different compositions, so there doubtless are many forms of protoplasm differing in as many respects from one another, and that these are all capable of differentiation to adapt themselves to special functions in the organism.

The mode of development of this highly complex substance, protoplasm, in the laboratory of nature is involved in great obscurity. It would seem incredible that it should have been formed directly out of the inorganic elements, and yet we find no evidence of the existence of the series of less complex organic compounds leading gradually up to it except as products of living organisms which presuppose the prior existence of protoplasm. We seem, however, compelled to suppose that such less highly compound bodies preceded this most highly compound one, and can only confess that we are as yet ignorant of the circumstances of their formation. Most of the protoplasm within the reach of observation exists within the bodies or tissues of living organisms whose origin is exceedingly ancient, and which are simply the modified products of millions of generations of genealogical descent from actual parents. In all this the formative power of nature in the initial production of protoplasm is excluded. The initial formation of the protoplasmic units is the real question involved in the controversy about "spontaneous generation," and it is precisely analogous to the question of the formation of ammonia or any other chemical compound.

It should be remembered that the lowest forms of life are found in the water. Water in its purest form consists of hydrogen and oxygen. It absorbs carbonic acid and ammonia with great avidity, and is never found in a natural state entirely free from these substances. In the sea, as also in all bodies of fresh water, it is always permeated by a vast number of salts and solids of all kinds, and contains a small percentage of sulphur. The waters of the globe, therefore, contain all the elements that ever enter into any living organism, and especially the constituents of protoplasm. The liquid state must also be regarded as by far the most favorable of all for the transformation and re-formation of compounds of all orders and degrees. In the gaseous state the molecules are ever tending to fly away from one another and remain uncombined, while in the solid they can not overcome their own inertia sufficiently to unite. In the liquid state they mingle freely, and full play is allowed to their elective affinities. That amid this constant intermingling of all the elements, and many of the lower compounds that enter into the more complex organic bodies, there should be frequent formation of many of them, would seem a most reasonable conclusion. Such formations would be likely to escape detection, from a variety of causes. It is not probable that compounds thus formed under special circumstances, and then left to the play of constantly changing circumstances, would possess any great degree of permanence, or ever exist in any great abundance. Like the clouds of the sky, these "creatures of circumstance" would constantly form and vanish, and again re-form, again to disappear.

In this manner there may be constantly forming and disappearing organic compounds of many kinds and degrees. Organic radicals (ethyl, methyl, amyl, etc.), organic acids, alcohols, ethers, amyloid and saccharine bodies, protein and albuminoids, may all be thus spontaneously formed in such limited quantities and in this transient manner in the waters of the sea, at certain points where all the circumstances conspire to such a result, and several of these may frequently commingle and generate new compounds of still higher orders. That this is actually the case we, of course, do not know, but if it were we certainly should never detect the presence of these diffused substances.

Although, in the solid and dry state in which the various organic compounds are usually presented to our inspection, the lower or less complex ones appear to be and are the most stable, it is probable that this may be, in a sense, reversed in the case of their formation in water by the natural cohesion of commingled molecules. Many of these substances are soluble in water, and this property would be increased by the presence of alkalies that abound in the sea. The albuminoids would perhaps be no more stable, but, amid all the multitudinous combinations which it is possible to conceive of as thus being brought into existence, some comparatively permanent ones would be likely to result. For there may be supposed to be going on among the many forms of matter that freely commingle in the ocean a continuation of that same selective process which was described (*supra*, p. 233) as possible among the original molecules of imponderable matter, which resulted in the production of a few stable elements, and again among the elements that composed the incandescent nebula when the metals, etc., were created, and which we shall see again still more clearly going on among morphological units and developed organisms. It is a "struggle for existence," a selection by which the feeble aggregates are disintegrated and the strong ones preserved; another illustration of the law of the "survival of the fittest," the final outcome of which is the production of stable organic aggregates. The lower compounds have scarcely more than a nominal existence. Out of correspondence with their environment they quickly return to their original inorganic state unless, perchance, they be developed in the midst of others whose combined influence tends to the production of more complex ones, and eventually of the truly stable form. All the intermediate stages may be regarded as merely "transition forms," whose well-known ephemeral character they fully share, or as those countless failures of nature which are always necessary to the consummation of one success. In this case the grand success is protoplasm. Until this is reached, all is failure.

It is a matter of fact that protoplasm is found in the sea and in water under circumstances which fully accord with this theory of its formation. Haeckel's *Protogenes* and Huxley's *Bathybius* are examples. These are *chemical substances* of the composition stated above, and possessing properties due to such composition. The latter is found at the bottom of the sea, where it exists in large masses as a true chemical product of the varied contents of the ocean. To distinguish these wholly amorphous and spontaneously developed forms of protoplasm from that which is found in the tissues of true organisms, Professor Haeckel proposes to apply to them the term *plasson*, or *plasson bodies*, which, while it should not lead to the notion that there is any essential difference in the matter itself, is convenient to keep fresh the idea that it is a true chemical substance.

It is difficult to describe the properties of the plasson bodies without giving rise to the idea of life, for the leading property is that of spontaneous mobility. Anything that moves is naturally supposed to be alive, and, if this is a test of life, all forms of protoplasm are living things. And there is really no objection to this view, provided the idea of life be confined to this and a few other simple phenomena. But the tendency always is, to couple with the idea of life that of organization. We are apt to think of nerves, muscles, joints, and sinews, if not of mouth, stomach, limbs, and sense-organs. From plasson bodies all these are as completely wanting as from a lump of gypsum. The spontaneous movements and all the transformations through which these substances pass are simply the result of their peculiar chemical composition and constitution. These activities belong to them in the same sense that sweetness belongs to sugar or bitterness to quinine. In fact, the primary distinction between these most complex of all known bodies and the less complex ones is that, while in the latter all the activities are molecular, in the former they are partly molar. The units of these substances, compared to those of any of the less complex ones, amount almost to masses, although still far too small to be distinguishable by the highest microscopic powers. But the peculiar distinction is found in the power of these large complex molecules to combine into masses and manifest activities in unison, consisting in the movement of these masses or of special portions of them under the influence of appropriate stimuli. The secret of their stability seems to be their power to perpetuate or continue their existence by the attraction and absorption of additional assimilable materials. This may, at first sight, seem to be a truly vital process, but, whether it be or not, it is, after all, only an extension of the powers which originated it. All bodies must possess, or must have once possessed, the power of increasing their mass. The inorganic bodies which we know as solids are stable as we see them, because the conditions of great heat, etc., which existed at the time of their formation, no longer exist. To compare them to the organic bodies under consideration here, we should be obliged to refer them to that period, and to suppose the existence of such conditions. These conditions are necessary to their formation, but they are at the same time fatal to their continuance. The plasson bodies, in order to survive the destructive tendencies of their surroundings, acquire, instead of a firm armor of resistance to such tendencies, a means of self-renewal by which their existence can be maintained and perpetuated. They possess the power of assimilating to themselves all substances whose chemical composition is identical with or very similar to their own. Two bits of protoplasm brought into contact blend into one. If one be much the larger, it appears to devour the smaller. Masses of protoplasm assimilate protein substances and by re-compounding them convert them into protoplasm also. Living organisms containing, as they always do, protoplasm in their tissues, are, if of proper size, absorbed, and, as it were, devoured by plasson bodies, and the assimilable parts dissolved out and appropriated. In order to accomplish this, mechanical means are frequently employed. Certain portions of a plasson body are temporarily protruded from the mass in the form of *pseudopodia*, or false limbs, and, by means of these, infusoria and other minute organisms are seized and drawn into the mass. This might be regarded as at least a sort of false organization. That it does not deserve to be called true organization is clear when we remember that before this can take place a still higher degree of composition must be reached. The unit of protoplasm is only chemical, or at most physiological. All organization is produced by the multiplication and special disposition of *morphological units*. No plasson body is strictly such a unit, of however few chemical units it may be composed.

These plasson bodies have recently been made to constitute a special field of scientific research, and, as much by accident as otherwise, it has been occupied by the biologists instead of the chemists. These, like judges on the bench, have constantly ruled in favor of their own jurisdiction, and in this way these substances have come to be regarded as forms of life, although their biographers have, from the first, insisted that they are not organized beings. Perhaps this bit of history is not unfortunate, since it teaches us to disconnect the ideas of life and organization, and thereby directs our thoughts toward the most profound truth, both of biology and of chemistry, which is, that *life is the result of the aggregation of matter*.

A plasson body performs all the essential functions of a living organism. It is capable of motion, nutrition, and propagation. To these Professor Haeckel adds sensation, for how can the other functions be conceived of without the aid of this one? But we might almost as well ask, How can a crystal grow without sensation? Nor has the great naturalist failed to perceive these extreme consequences of this extension of the biological jurisdiction, for he seeks to escape them only by pushing it still further, and proclaiming the doctrine of the animation of material atoms of the lowest order, *die Atom-Seele*.*

It should be stated that there are two kinds of organization which ought never to be confounded. There is chemical organization and there is morphological organization. The first is the organization of matter proper, the second is the organization of special forms of matter. From the broadest cosmical point of view, it is true, these may be said to differ only in the mass of the units involved, but from the more practical point of view, which seeks to comprehend the phenomena of life as distinguished from that which is not life, the separation of the two classes of organization is of great value. For example, if an answer is demanded to the question, long ago asked, whether life is the cause or the product of organization, this answer will depend entirely upon which of the two kinds of organization is meant. If chemical organization is referred to, then life, as the term is popularly understood, is a product of it. If only morphological organization is to be considered, then, in a certain sense, life may be regarded as a cause. It is at least certain that, before anything more nearly allied to life than molecular activities is observed, there must be a long series of compoundings and re-compoundings of the elements of matter, which is what we mean by chemical organization; while, on the other hand, it is equally certain that, before anything that biologists will recognize is reached, the matter which performs the vital functions in all organized beings has an independent existence, and possesses all the properties manifested

* "Die heutige Entwickelungslehre," S. 14, 23.

later. Whether there be or not a causal dependence between the phenomena of life and those of these two classes of organization, there is, at least, an order of sequence such as has been pointed out.

Thus far we have confined our discussion exclusively to the organization of matter—to chemical or molecular organization. And, without stepping over this line, we have now brought ourselves face to face with the phenomena of life. While still dwelling upon the composition and physical properties of chemical substances, we have encountered the problem of vitality. Looking at this problem thus as it were from below upward, we are able to observe its very roots, and thus to gain a far more fundamental idea of life in the abstract than could have been gained by a direct consideration of organized beings themselves.

The great truth that now comes squarely home to us is that *life is a property of matter*. It is simply the result of the movements going on among the molecules composing a mass of protoplasm. It is a phenomenon presented by this most highly complex form of matter, and which is never absent from it. To kill protoplasm is to destroy its composition, to degrade it into a lower order of substance. The activities, powers, functions, and susceptibilities possessed by this substance, whose combined effect we denominate life, are but the relations which the substance sustains by virtue of its constitution to the forms of matter around it. They are its properties just as astringency, transparency, etc., are the properties of alum.

All the known plasson bodies have been denominated by Professor Haeckel *moneres*,* or *moners*, although in some cases, as in Huxley's *Bathybius Haeckelii*, the protoplasm is scarcely individualized, and exists at the bottom of the sea at the depth of from ten to twenty thousand feet in immense

* I have been unable to find any satisfactory etymological grounds for the plural *monera* used by Professor Haeckel.

quantities and amorphous masses, mingled with coccoliths and *Globigerinæ*. When taken out, this substance was observed by Sir Wyville Thomson and Professor William B. Carpenter to undergo spontaneous movements. On careful analysis it was found to consist of protein matter, and to contain carbon and nitrogen. With regard to this substance there has, it is true, been some question, but the effort to overthrow the theory of its protoplasmic character seems to have been made by persons who feared the consequences of that theory more than they loved truth, and, unless better proofs can be adduced against it than have thus far appeared, Bathybius will have to stand.* The facts of its protein constitution and spontaneous movements are sufficient alone to make it a plasson body. That it is in the biological sense organized no one claims. It is also an interesting fact in its history that, before its chemical constitution was known, its amœboid motions were observed by two eminent scientific observers, neither of whom has ever been accused of undue leanings toward the advanced theories of modern biology. These men stated that it was "capable of a certain amount of movement, and there can be no doubt that it manifests the phenomena of a very simple form of life." They further say: "This ooze was actually living; it collected in lumps, as though albumen had been mixed with it, and under the microscope the sticky mass was seen to be living sarcode."

A similar substance, or, as Haeckel thinks, the same substance, was discovered in Smith Sound, at the depth of 552 feet, by Dr. Emil Bessels, of the ill-fated Polaris. The writer of this work had the good fortune to hear Dr. Bessels describe this discovery, soon after his return, in a paper read before the Potomac-Side Naturalists' Club of Washington, D. C. He found it in even more pristine simplicity than *Bathybius*, and unaccompanied by either coccoliths or *Globi-*

* See Haeckel's defense of Bathybius in "Kosmos," 1877, and Huxley's remarks at the close of Professor Allman's address before the Sheffield meeting of the British Association, August 20, 1879.

gerinæ, from which circumstance he named it *Protobathybius*. It is described and figured in the report of the expedition.* Of it Dr. Bessels says: "These masses consisted of pure protoplasm, in which calcareous particles occurred only by accident. They appeared to be very sticky, mesh-like structures, with perfect amœboid movements; they took up particles of carmine and other foreign substances, and there was active motion of the nuclei."

The existence of such substances as these is an astonishing fact, and can not be robbed of its interest by any attempt to show that they are simply chemical products of the sea. No biologist should claim more. The peculiar force of the lesson they teach is derived from just this circumstance. While it seems to point to the sea as the common mother of all life, it also shows that a simply chemical substance can manifest the phenomena of life. To paraphrase Bacon's aphorism with the proper modifications, it may be said that, if a substance displays all the phenomena of life, let wise men dispute whether it be living or no (vol. i, p. 288).

In addition to these examples of perfectly amorphous protoplasm, all parts of which present these truly vital properties, which are no more affected by division at any point than are those of a mass of dough, there are other true moners whose individual character is well defined. In these each individual consists of a small (usually microscopic) mass of wholly undifferentiated protoplasm which, like drops of water or any other fluid or semi-fluid, has the spherical for its normal form, but possesses the power of improvising pseudopodia and protruding them in any direction for the capture of nutritious objects that chance to pass within its reach. Moners of this class differ somewhat in size and in certain characteristics upon which a classification into genera and species has been based. The principal differences are displayed in the mode of protruding the pseudopodia and of

* "Die Amerikanische Nordpol Expedition," Leipzig, Wilhelm Engelmann, 1879, S. 320, 321.

multiplying individuals. With regard to the latter function, Professor Haeckel gives three distinct modes in which it is accomplished by different kinds of moners. One of these modes is that of simple division, which takes place as soon as the individual, through the absorption of nutritious elements, has attained a given size, each half again increasing and again dividing. Another mode is that of gemmation, the individual, on reaching the maximum dimensions, putting forth a little bud into which the matter henceforth assimilated seems to go, until it reaches a size approaching that of the parent, when it separates and becomes a new independent individual. The third mode is much more remarkable. The entire individual, after it has reached complete maturity, suddenly resolves itself into a great number of minute germs, each of which becomes a new individual, increases in size, and again breaks up as before. The first two of these processes remind us strongly of the modes of propagation of many well-defined animal organisms, as, for example, of Vorticella, Hydra, etc.

The actual existence of moners was first made known by Professor Ernst Haeckel,* to whose researches the world is indebted for the greater part of its information respecting these wonderful objects. It was in 1864 that he discovered in the Mediterranean his famous *Protogenes primordialis*, since which time some fifteen more have been identified and described. For thorough descriptions of most of these the reader is referred to his "Monographie der Moneren," published in 1868, and the supplement thereto, published in 1877.† Other naturalists, particularly Cienkowski, have also made these forms a special study, and added largely to our knowledge of their nature.

* For evidence that Lamarck had seen and described actual moners, see the "Philosophie Zoologique," vol. i, pp. 208, 281.

† In his "Protistenreich," kindly sent me by Professor Haeckel since the above was written, this whole field is greatly enlarged and made to embrace the *Bacteria*, *Vibriones*, etc.

These forms, as already stated, differ as they may in other characteristics, are simple, homogeneous, chemical substances, and consist of pure, undifferentiated protoplasm, whose properties alone they manifest. These properties are essentially those of life, and the further we explore the secrets of that wonderful phenomenon, the more probable does it become that all the higher forms of vital activity exhibited by the most highly organized animals are nothing more than special manifestations of these same properties residing in this same substance, variously enlarged in area of influence and intensified in degree of power by the complicated mechanism of organization. In reaching the substance protoplasm, we have not only reached the fact of life itself, but in its properties we behold all there is essential to life. The rest is but the mechanical husbanding of the essential principle, and its general application to high and complicated machinery. The mone is Hero's engine, the vertebrate is the modern locomotive; the power that propels is the same in both. The observed advance is not in the *force* but in the *organization.*

From this point, therefore, the progress of life is that of the morphological organization of matter. We have reached the end of the process of chemical organization. The highest of all chemical substances is protoplasm. Its chief property is life. Its chemical unit or molecular aggregate is a compound of protein or albuminoid molecules, and possesses a complexity and variability which place it wholly beyond the power of our imperfect chemistry to formulate it. But, although this purely chemical and molecular re-compounding of matter is thus able to evolve life, it can only of itself evolve the most rudimentary form of life. To carry this wonderful property up into more exalted forms requires still further combinations of material elements, still higher degrees of aggregation.

In Nature's processes, as in those of man, there are limits to the application of means. The molecular aggregate or molecule, as defined above, seems to have reached, in the composition of protoplasm, the limit of its possible application in the further aggregation of matter. The great size, complexity, and instability of these ultimate chemical units render them incapable of any further aggregation of the same kind. To secure the further organization of matter other means must be employed, a new process must be introduced. Had no such new process developed itself among the infinite number of trials which, under the law of evolution, Nature still continued to make, the formation of the chemical substance, protoplasm, would have marked the highest form of material progress on the globe. But amid thousands of failures one process proved a success. This process consisted in the development of *morphological units*.

This development began by the differentiation of the plasson bodies. An individualized moner may be regarded as some advance upon the undifferentiated mass of sarcode which constitutes *Protobathybius*. The first step may therefore be said to be the individualization of protoplasmic masses. This is a mechanical process, and, though itself not organization, is a preparation for organization. The first true differentiation consists in the formation of a central portion of different constitution from the outer portion of the spherical plasson body. Such a differentiation actually takes place, and has been repeatedly observed in the embryological study of the lower animals. Of its occurrence in nature among the true moners, we know as little as we know of the original creation of these forms, but of the existence of forms thus differentiated there are abundant examples. Of these the *amœbæ* are the most familiar, but there are many more. This differentiated central portion may be supposed to vary in its degree of difference from the surrounding protoplasm in all possible shades, and thus there may exist a complete series of gradations from the wholly undifferentiated protoplasmic spherule, or *cytod*, to the form having a well-defined central nucleus and surrounding protoplasm.

This latter structure, in the now accepted terminology of histology, is called a *cell*. The cell, therefore, is the primary morphological unit, or unit of organization, and the basis of all higher organic development.

In biological language, the cell is the individual of the first order, and all individuals whose structure consists of a simple multiplication of cells or cohesion in any form of more than one cell, also belong to the first order. Individuals of the second order are compounded of two or more of the first which enter into them as units, and so of higher orders. In this the process of physiological aggregation is identical with that of chemical or molecular aggregation. The fundamental distinction consists in this: that a molecule, or chemical unit, is a compound of *heterogeneous* molecules, or molecules of different *species*, as carbon, oxygen, hydrogen, nitrogen, etc.; while a cell, or morphological unit, is a true molar aggregate consisting of a mass of *homogeneous* molecules of protoplasm. Herein consists the essential distinction between chemical or molecular and morphological or mechanical organization, between the organization of matter itself and the organization of the forms of matter, the former of which is the cause and the latter the product of the vital properties of matter or life in the abstract.

The cell is the lowest form that can properly be termed an organism. A moner is only a plasson body, a spherule or minute lump of protoplasm. Bathybius and Protobathybius are but masses of this chemical substance. But the cell has a trace of true organization. The protoplasm of its exterior, though identical in chemical composition, is different in mechanical constitution from that of its interior. This is a step in the direction of physiological organization. Haeckel styles this differentiated nucleus of the cell a *germ*, and believes it to constitute simply an organ of propagation. This conception he bases upon the fact that, in the reproduction of cells, it is the germ which first divides, and the surrounding protoplasm then arranges itself about each division.

The fundamental distinction between living and non-living bodies consists in the fact that in the former the existence of each individual aggregate, of whatever order, depends upon the perpetual renewal of its substance, which is subject to perpetual waste, while in the latter the same molecules persist; or, if we admit, as we undoubtedly must, that all forms of matter are subject to ceaseless change, whereby every aggregate must in its own good time be transformed and redistributed, then the distinction may be reduced to this: that in non-living aggregates, as a rule, this change is secular, and the same form is not generally renewed, while in living aggregates the change goes on rapidly, and *pari passu* with it the process of renewal takes place, thus maintaining, during the period which is to constitute the life of an individual, an identity of form without identity of matter. The petrifaction of wood might be instanced as an analogous process in non-living matter, but, besides being much less rapid, it exhibits this fundamental difference: that the new form, though identical in shape, is composed of wholly different elements; it is a different substance.

In the living aggregate, composed as it is of protoplasm alone, or of this combined with such other matters as protoplasm is capable of appropriating and weaving into tissues, so large, complex, and unstable are the chemical units that they are perpetually falling back into simpler and more stable states. It seems that, in the very process of assimilation by which aggregates of lower orders are re-compounded into protoplasm aggregates, portions of the substance employed in performing this function "lose their balance," as it were, and relapse into the lower state. The same occurs with every movement of the protoplasmic mass, whether made for the purpose of assimilation or for any other, and thus the chemical units of the aggregate are continually breaking up into the lower organic compounds and being rejected as waste material. The individual, therefore, can only exist so long as it is able to appropriate new material from the surrounding medium. This process of appropriation is denominated *nutrition.* Where nutrition is in excess of waste, as is normally always the case, growth, or increase of bulk, takes place. But to this also there must be a limit. This limit varies with the species, but probably depends chiefly on the important principle, insisted on by Herbert Spencer, that while masses vary as the cubes of their dimensions, the power to resist disintegrating influences varies as their squares. Many organisms seem to remain stationary at a certain maximum size, but this is only apparent. During all this period, whether long or short, there is a constant struggle between the forces of nutrition and dissolution, which is usually rhythmical, but always terminates eventually in the triumph of the latter. In this respect living aggregates differ from non-living ones only in degree, but the degree is in most instances immense, yet perhaps not far out of proportion to the contrast between the mass of their respective molecular units.

There are, however, many ways in which the speedy termination of the existence of living aggregates is arrested, and their existence in a modified form is continued during relatively immense periods.

In certain of the moners, as we have already seen, when the maximum bulk is attained, instead of dissolution ensuing, fission takes place, the spherical individual resolving itself into two similar spherical individuals of only half the size. These new individuals then continue the process of assimilation exactly as was done by the parent whole, until, arriving in turn at the limit of growth, division again takes place, and so on indefinitely. This same process, as was pointed out above, has been observed in a large number of true organisms of higher orders. It is called reproduction, but is in reality only a new form of nutrition, or rather a process preparatory to continuing that of nutrition, which was the direct cause of its occurrence. And, rightly viewed, all reproduction admits of this explanation. In the case of budding, which is so common also among more highly organized forms, this principle is only less obvious than in that of division. The nutritive matter which continues to be absorbed after the limit of growth is reached, no longer able to distribute itself through the organism as before, now finds a new channel at some point at its periphery, and begins to deposit itself there in the form of a bud which is in the nature of a new individual, and eventually becomes one by complete separation from the parent. The third mode of propagation described by Haeckel as taking place in certain moners, as in *Protomyxa aurantiaca* and others, in which the entire individual suddenly resolves itself into a great number of minute individuals, is partially paralleled by certain higher organisms in which the parent ultimately assumes the form of a sac filled with the new germs, which, after absorbing all the nutritious matters the sac contains, finally burst its membranous walls and come forth as young individuals. Here the parent, or, as it is called, "nurse," is completely sacrificed to the offspring. Judging from the plates of Professor Haeckel representing the reproductive process of *Protomyxa*, it would appear that in this case also a thin film or membrane remains after the change occurs, which is clearly the homologue of the "nurse's" sac.

This process may, perhaps, be regarded as the rudimentary form, from which has been gradually developed the ordinary process of reproduction observed in higher organisms. A gradual reduction takes place in the completeness with which the parent organism is sacrificed to the offspring, accompanied by a corresponding reduction in the number of the latter, until at length the condition is reached in which a few germs are differentiated from a certain specialized part of the body of the parent and expelled therefrom without injury to the parent, which process may be repeated many times during its life. Many animals and plants * are known to reproduce in this manner, at least during many generations. The process is known as *parthenogenesis.*

Sexual differentiation, which has taken place in most advanced forms, whether animal or vegetable, is quite independent of the primary principle of reproduction. It is not, however, incapable of rational explanation.

The power of plasson bodies to absorb and assimilate protein substances would seem to carry with it the power to absorb other plasson bodies also, provided in both cases the bodies to be absorbed be of proper size and character. In fact, in the appropriation of organisms of far higher structure by such bodies, we must suppose that the protoplasm found in the tissues of the former is not first degraded to the nature of protein bodies and then re-manufactured into protoplasm, but that it is directly incorporated as protoplasm into the plasson body to be nourished. It is therefore natural to suppose that, where such bodies exist together, occasionally coming in contact, the tendency of each to nourish itself by appropriating the other will manifest itself, and there will be occasional absorption of smaller by larger individuals. This is a perfectly normal form of nutrition. Where the two individuals coming in contact are very similar and of equal size, the tendency of each to appropriate the other may most frequently prevent any result, the morsel in each case proving too large. But it may also frequently cause a complete coalescence of the two individuals. The resultant individual would then contain twice as much matter as either of the component individuals, and yet it would continue to exist as a plasson body. But it must now be regarded as another species. Although this phenomenon has not as yet been observed to occur among recognized

* Sachs, "Lehrbuch der Botanik," S. 278, 876; Adrien de Jussieu, "Cours élémentaire de Botanique," 1840, p. 463.

moners,* there are certain unicellular organisms in which it is known to take place. This occurs with the lowest zygospores, as with the *Volvocineæ*, *Desmideæ*, and *Mesocarpeæ*. Although clearly a mode of nutrition, it is here denominated reproduction or propagation. It is in fact both, and the two are one.

Now, without delaying to trace out the progress of development of this principle, we may consider those animals very much higher in the scale in which two germ-cells, indistinguishable in form and size, are secreted from a special part of the interior of the body, either of the same or of different individuals, by means of whose union and complete coalescence the germ of a new individual is generated. This germ so produced grows in the normal mechanical way into an animal resembling the parent, but this depends upon another law. The germ-cells must be regarded as obeying the same laws as other cells, and the process is here, so far as these are concerned, identical with that which a couple of desmids present. And just as in the zygospores the mode of conjugation is gradually differentiated, until in the *Myxomycetæ* the coalescing cells are more or less active and dissimilar, and until in higher thallophytes, as in *Coleochæte*, etc., the comparatively large and passive *oogonium* is truly impregnated by the comparatively minute and active spermatozoid, so in the higher organisms there occurs a parallel differentiation of the cells specially secreted for purposes of reproduction, until we have the strongly contrasted germ-cell and sperm-cell, the *ovum* and the *spermatozoon*.

In the case of higher organisms, in which the cells performing the reproductive function are simply recommencements of a new life for the organism, which, by the laws of growth, they eventually produce, we must suppose that it is

* It seems that a true conjugation takes place in certain monads, or *Heteromitæ*, some of which possess a nucleus and contractile vacuole and others do not. These creatures, therefore, probably belong to Professor Haeckel's "Protistenreich."

some advantage in the accomplishment of this latter object that the coalescing cells be dissimilar. The existence of a simple cell separate from any tissues must at best be very precarious. Consisting as it does of the complex and tottering protoplasm, it requires all the aid attainable to prevent it from succumbing to the adverse influences surrounding it, and anything that can afford this aid must be a great advantage to its life and to the future of the species. But no two cells are ever precisely alike, and the result of the coalescence of two cells, however nearly they may resemble each other, is certain to add something to the resultant cell or body which neither of the components possessed. This addition may perhaps be as likely to be injurious to its existence as beneficial, but, if so, the resultant products thus deteriorated would disappear under the law of survival of the fittest, and only those in which it was not disadvantageous to have thus combined would survive. Between those in which the blending, though not a positive disadvantage, was no positive advantage, and those in which it was such an advantage, the race would, in the long run, be in favor of the latter, and the former would gradually disappear from the contest. The same process would continue among those possessing different degrees of this advantageous property, until by the simple law of natural selection such a degree of differentiation would be eventually reached as would be most advantageous to the well-being of the species. In this way all the phenomena of sexual polarity, as well physiological as morphological, have in all probability been brought about. Not only has one germ-cell in nearly all cases been made to differ from the other in size and form, but they have been endowed with very different activities and properties. In the vast majority of cases the distinctive male and female characters have been made to appear.

The female cell is usually very much larger, and spherical in form, and is surrounded by a membrane or coat (the *chorion*). It exhibits no movements of its own, and remains stationary, performing a perfectly passive *rôle.* The male cell is comparatively minute, often not a thousandth part the size of the female cell. It is usually spindle-shaped, and possesses distinct fore-and-aft portions. The head is much larger, the body part tapers gradually backward, and is continued into a more or less attenuated caudal extremity. In the proportions of these parts, as in many other respects, it varies greatly with different species, but these are its general characters. It possesses no membranous coat, and is endowed with very active powers of automatic movement. The coalescence takes place by the male or sperm-cell penetrating through pores in the membrane of the female or germ-cell and becoming absorbed by the latter. Those who have most attentively watched the entire process now positively assert that immediately after the coalescence the contents of the new cell become entirely homogeneous by the total disappearance of both the sperm-cell and the nucleus of the germ-cell, and are reduced for a brief period to the condition of a cytod, like *Protamœba.* A new nucleus is, however, soon formed out of the contained protoplasm, and the germ again becomes a cell. This new cell, endowed with the properties of the two widely dissimilar cells, is now capable of developing into an organism like the parent.

The important lesson which these facts teach will be considered later. We may now recur to the processes of sexual differentiation and the different modes of propagation, and note the truth, which comes clearly out of these details, that sexual propagation is the result of successive modifications of the third mode observed in moners, in which the protoplasm, as soon as its limit in size has been reached, breaks up into many small but otherwise similar bodies, which each repeat the same process. It also clearly exemplifies the truth that reproduction is nothing more, even in its most extreme phases, than a modified form of nutrition.

Of the two asexual forms of reproduction, viz., division and budding, the former obtains only in a few of the lowest organisms, proving its unfitness for higher stages of organization, while the latter is not found in higher animals, but goes hand in hand with sexual propagation throughout the entire vegetal series. It may in fact be here regarded as the common and normal form, and is only supplemented by the sexual form as a sort of safeguard against adverse circumstances. In climates where cold and warm seasons alternate, many plants revert to complete renewal from the seed each year, and but for sexual propagation would speedily perish (annuals). Others would survive but a few years from budding alone (perennial herbs). But in warm climates there are many plants whose roots put forth new buds at intervals, and which thus reproduce their kind without the aid of sexual propagation; so that, were this wanting entirely, the vegetation might continue for an immense period. It appears, however, that there is no plant above the thallophytes in which the organs of sexual reproduction are entirely wanting, or in which they are not at times observed to perform their functions and renew the species.* The exclusive resort to sexual propagation by all higher animals is one of the fundamental facts that distinguish the two great biological series.

The particular manner in which the higher living organisms have been developed from the plasson bodies or undifferentiated protoplasm has not been observed, and can not be empirically known. Processes of this kind are secular, and do not occur in such a way that their dynamic stages can be observed. From this circumstance some have found reason to charge those biologists with theorizing who assert that development must have taken place. But the biologist no more theorizes in maintaining development in his department

* The seedless plantain, banana, bamboo, etc., which have been introduced into the warmer parts of America from those of Asia and Africa, and which propagate solely by buds, can scarcely be called exceptions, since by long cultivation in their original home their habits had probably been fixed before they reached American soil.

than does the geologist in maintaining it in his. Neither can observe the process of change, except under very peculiar and limited circumstances. Both must judge from the existence of transition forms, and where gaps occur both must fill them by rational deduction from known facts. The gaps in the geological record are known to every body, but they are nevertheless not sufficient to prevent cultivated persons of all classes from yielding complete acquiescence to the leading truths of geological development.

The biologist has the following facts as the data from which to infer the development of living organisms from inorganic matter: He has, first, the protein, or albuminoid substances, which contain all the elementary matters that are found in the tissues of organized beings. He has, secondly, large amorphous masses of undifferentiated protoplasm existing at the bottom of the sea, and presenting all the phenomena of life without organization. This substance is identical with the matter found in nerve-cells, blood-cells, and muscle-cells, as also in the cells of plants, and which, wherever identified, possesses this same property of spontaneous activity. He has, thirdly, individual plasson bodies composed of this same substance and endowed with the same activities, but possessing specific dimensions, so as to constitute them distinct individuals. These vary in some respects sufficiently to be classified into genera, and even families, and possess the powers of locomotion, nutrition, and reproduction; they are *living things*, though as yet wholly unorganized. He has, fourthly, simple living cells, differing from these plasson bodies in nothing but the possession of a nucleus at the center of the mass of protoplasm of which they are composed. This nucleus consists itself of protoplasm, and differs only in its consistency, color, etc.. *Amœbæ* and other unicellular creatures of this class swarm in all waters, both salt and fresh, and have long been known, named, and classified by systematists. Finally, the biologist has the further fact that all organized beings whatever, whether animal or vegetable, are made up of combinations of these cells, which constitute the morphological units of biology.

With this series of connected facts leading from the inorganic to the organic world, the biologist may well inquire what he is expected to prove, if these are not sufficient. And he justly maintains that the positive demonstration of the truth of development follows from the establishment of these facts. If it be denied that these facts are established, he may admit that further evidence on many points is desirable, but it must come from chemists and histologists, who are earnestly invited to review all the knowledge thus far gained, and, if defective, to correct and amplify it. Attempts to overthrow the doctrine of development from other points of view than those of actual observation and experiment, which can be repeated and verified at any time, must prove futile, as they can not be entertained by science.

The cell, or morphological unit, once reached, the course of evolution is continued by substantially the same general law as that which we have observed to govern it during its antecedent stages. This law requires the aggregates of a higher order to be compounded with those of a lower, while at the same time masses are formed by the cohesion of many homogeneous units. The cell, though it must be regarded as a molar aggregate, since it is composed of homogeneous molecules of protoplasm, is nevertheless the unit of organization and of biology. This, as before remarked, is the only departure from the universal law of aggregation in the world below it. But, waiving this anomaly, the process of evolution is again resumed, with this anomalous aggregate as its unit, and continued in harmony with the general law. While a developed organism, composed as it is of cells as units, bears something the relation to its units that a chemical substance or molar aggregate of any kind bears to its molecular units or molecules, it must be further observed that such developed organism, besides being composed of cells as its ultimate units, is also composed of numerous proximate units, which, now greatly modified, once represented organisms of lower orders, and are now united by the law of integration in an organism of a higher order.

If we take a plant—a tree, for example—every leaf (giving to that term its widest theoretical application) and every bud represents an individual of the second order, itself composed of cells, or individuals of the first order. The whole tree, therefore, represents an individual of the thousandth or ten-thousandth order, according to its degree of ramification, and each branch exhibits the same fact on a reduced scale. The tree is, therefore, a compound organism, into whose *ensemble* there enter a vast number of individuals of different orders in a regular ascending hierarchy. This may, perhaps, be best illustrated by the inflorescence of plants. If the solitary and terminal flower be taken as the individual of the first (or any given) order, the raceme, spike, simple umbel, simple corymb, etc., would represent individuals of the second (or next higher) order, while the panicle, thyrse, compound umbel, etc., would represent individuals of the third, fourth, and higher orders, according to the degree to which the inflorescence was compounded.

In the animal series the *Annulosa* furnish good examples of the law of biological aggregation. Each ring of the body represents a distinct individual of the second order, and possesses in some species, as in *Tænia*, all the organs of a complete organism (vol. i, p. 182). Every worm (except some of the lowest, which are simple), every crustacean, every insect, therefore, is an organism of the third order, and contains as integral parts of its body, in more or less perfect condition, individuals of the second order. In most of these cases there are several of these secondary organisms united into the ternary individual, in which respect animals generally differ from plants. Even in the vertebrate type of animals this system of compounding is observable, although less distinctly so, each vertebra being regarded as a distinct individual of a lower order.*

With these general remarks we are now prepared to consider the mode of development of organized beings from the simple morphological or biological unit, the cell. True to the general law of aggregation, the first tendency of these morphological units is to cohere into masses or societies, and form collective individuals which are only slightly integrated, and whose units are still to a great extent independent. We find the Rhizopods living in colonies, of which one genus (*Cystophrys*) forms compound spherical masses, closely aggregated, yet so far independent as to be capable of changing their positions in the collective mass. The *Labyrinthuleæ* furnish another example of this kind in which the masses of simple cells are, as it were, woven loosely together by a maze of thread-like filaments.

In the next higher class of organisms the cells are firmly coherent into a thin membrane, only one cell in thickness, and this is rolled up into a perfect, hollow sphere. The cavity of the interior is filled with fluids, perhaps containing free protoplasm, while nutrient matters are absorbed by all the cells forming the external coat. These so-called *Blastospheres* occur with great frequency as a larval stage of higher creatures, but have their representatives among permanent forms, as in the *Volvocineæ* and *Flagellata*. *Volvox globator* is itself an example. This cellular coating, which forms the exterior of these hollow spherules, may perhaps be regarded as the lowest form of proper *tissue*.

All tissue is composed of cells which form layers and serve as membranes, coatings, etc., for the various vessels and organs of the higher forms of life.

In the larval stages of certain animals, as the Ascidians, and even of *Amphioxus*, there occurs a form which differs from the last described in having two layers of cells instead of a single layer, and also in the possession of an opening at

* Haeckel, "Anthropogenie," S. 578.

one spot on the surface through which nutrient matters are chiefly conveyed and waste materials expelled. The interior cavity in this case obviously performs the functions of a stomach, and we here see the first appearance of an *organ* in the animal kingdom.

Embryologists have long and faithfully studied the development of the organs and tissues of animals from the earliest embryonic stages, and they find that, in the progress from the simple cell which results from the coalescence of the two sexually differentiated cells of the male and female parent, there is in all cases, first, a process of division which soon results in a mass of homogeneous cells; that, next, these form a hollow sphere whose wall is composed of a single layer of cells; and that, later, this single-celled wall is converted into a double-celled wall. From this point the formation of the tissues, especially of higher animals, becomes complicated, but after one more doubling of the cells forming the germinative layers this process ceases, and all the tissues of even the most highly organized animals are developed out of these four primary layers of cells.

The stage of embryonic development in which the cellular wall consists of two layers of cells is called by Haeckel the "Gastrula stage," and all animals whose structure is more simple than this are by him classed as *Protozoa*, the appearance of the double layer being regarded as the true dividing line between the *Protozoa* and the *Metazoa* (or all animals higher than the *Protozoa*). These two primary layers are called respectively exoderm and entoderm. Each of these subsequently doubles, making the four germinative layers that constitute all the tissues of higher animals, and to these four layers there have been applied the following terms, commencing with the most exterior and passing through to the most interior: 1, the dermal layer; 2, the muscular layer; 3, the vascular layer; and, 4, the mucous layer.

The tissues which each of these layers ultimately forms are rudely foreshadowed by these names, but the task of following them out in the higher organisms, though a very delicate one, has been already most successfully performed, until the true genetic history of nearly every organ of the body is now quite satisfactorily understood.

The most remarkable fact which this class of studies has brought to light is that the embryological progress of every developing germ recapitulates, in the brief period of its course, the progress of all the forms below it. In other words, there is a period in the life-history of every higher organism in which the embryo bears a striking resemblance to the adult forms of each of the creatures below it in the scale of biological development. The obvious deduction has been drawn and is insisted upon, that those lower forms which the embryos of these higher forms so closely resemble stand in the line of the genealogical descent of the latter, and the corresponding stages represent in the brief embryonic history of the creatures the permanent stages of that long secular progress which the organic world has been making in past ages. This truth is so strongly substantiated by all the known facts that it has become the fundamental law of biogeny as taught by the advanced school of biologists.

The development of vegetal forms, though more simple, is analogous to that of animal forms. The lowest plants, or Protophytes, are strictly unicellular organisms, and therefore always of the first order. In short, they are living vegetable cells which never attain any higher development. In most cases they have proper motions of their own, and are therefore not to be distinguished from animals of the same stage of development, except by certain delicate and often questionable chemical tests. The presence of chlorophyl, as in the *Oscillatoriæ*, *Chroococci*, etc., is distinctive wherever it occurs,* but this is wanting in large groups, as in the *Schizomycetæ* (*Bacteria*, *Vibriones*, etc.) and in the yeast-fungus

* The existence of chlorophyl in some unquestioned animals, as in hydra, etc., is now believed by some investigators to be due to hypodermal parasitic plant-forms visible through the transparent cells of the epidermis.

(*Torula cerevisiæ*, or *Saccharomyces*). The surrender of the former of these to the botanists, after a long struggle, has been made in consequence of the fact that they have been proved to be capable of appropriating and assimilating purely inorganic matters.

We next find among plants the same collective or associated structure observed in the lowest compound animals. In *Pandorina* and *Stephanosphæra* such collective masses or balls are formed from the subsequent cohesion at the bottom of the water of cells which were at first free. Later we have the blastosphere type represented by *Volvox globator*, which has also been remanded to the botanists, although a very active creature. From this stage of structure an almost endless variety follows, dependent, as Mr. Herbert Spencer has so ably demonstrated, on the nature of their surroundings and the manner in which they are affected by incident forces (vol. i, p. 181). But the modes of compounding simple cells are far more varied and multiform in plants than in animals. In fact, no vascular tissue appears until the ferns or club-mosses are reached, although long before this true leaves have been differentiated from the primordial thallom. In *Caulerpa denticulata*, in addition to a creeping stem and fibrous tufted roots, which are wholly cellular, there are formed broad, leaf-like expansions, also purely cellular; but there is this remarkable peculiarity, that none of the cellular units contain any nucleus, but all remain in the cytod stage. This fact shows that even the cell, as usually defined, is not necessarily the unit of organic existence, but that still simpler forms of protoplasm may develop organisms of considerable complexity of structure.

The *mycelium* of the fungi consists of fine threads composed of cylindrical cells placed end to end, while the larger fruiting portion of these plants is made up of cells, also loosely woven together, and often widely separated by intercellular cavities. When ripe, certain of these cells are set apart and inclosed in appropriate sacs or cavities as spores, and these contain the germs of future plants. Although no true sexual organs have been found in the commoner fungi, many botanists believe that the spores are the product of a sexual process that takes place in some way within the mycelium. Throughout the thallophytes this simple cellular structure prevails in all the organs and parts, scarcely ever becoming differentiated into anything like fibers or vessels. In the *Muscineæ* such a differentiation takes place sparingly. We here find the exterior layer of cells much more compact, and sometimes interrupted by pores forming a rudimentary *epidermis.* Through the stems and often through the center of the leaves there runs a line of elongated cells forming a rudimentary axis or fibro-vascular bundle. The formation of true foliar appendages also first appears here. From these the vascular cryptogams (ferns, *Lycopodiaceæ*, etc.) are distinguished by the existence of distinct fibro-vascular bundles, whose function is to lend support to the plant. They consist of bundles of fibers which are formed by a high degree of differentiation of the primitive cells, and which extend through nearly all parts of the fronds of these plants, and are very numerous within the stem. The fibro-vascular bundles are to plants what the skeleton is to an animal, and by their aid the higher plants are enabled to produce a great variety of complicated organs, and often to attain a large size.

In propagation by means of buds, which is the ordinary mode with most plants, very little of the degree of organization attained is lost; only the buds and young shoots are more juicy, have looser tissues, and less distinct axial organs and vessels. But whenever sexual propagation takes place there is a complete return to the primordial unit of vegetation, the cell. The ultimate product of sexual differentiation is the female ovum, or germ-cell, and the male spermatozoid, or sperm-cell. The former is usually, but not always, passive and devoid of spontaneous movement. The latter is usually very active, and possesses the same form as that found in the spermatozoa of animals, viz., that of the "lash-cell." In many cases it is very slender, and the caudal portion is much attenuated. It never has a membrane inclosing it, and consists entirely of protoplasm with a minute nucleus in the center of the anterior portion. The spermatozoid penetrates the *oogonium*, and mingles its substance with that of the female germ-cell. The process throughout is the same as that which takes place in animals. In the highest orders of plants the spermatozoid becomes inactive, and is brought by other agencies into contact with the female ovaries. The pollen-grains of phenogamous plants are carried by the wind or by insects to the stigmas of the female flowers, and there send forth a long tubular cell (the pollen-tube), which penetrates to the ovules, however great the distance may be, and fertilizes them. There is, however, here as before, a blending of the contents of the two cells, and a subsequent development of the new organism. Could a thorough study of the embryology of plants be carried on, it would probably confirm in the vegetal kingdom the law above enunciated, so well established in the animal kingdom, of the embryological recapitulation in each germ of the course of development which the parent plant has passed through in order to reach its present stage of organization. But obstacles thus far insurmountable have prevented the prosecution of this study.

We have seen that life in its essence results from the organization of matter—from chemical or molecular organization. That kind of organization of which biologists take cognizance is due to the mechanical adaptations which are effected by the action of this life-principle or vital energy upon the other materials with which it comes in contact. The pure life-substance, protoplasm, can make no great progress in organization so long as it is left to itself. In order that it build, it must possess materials suitable for the purpose. Protoplasm is far too unstable and changeable in its constitution to form a structure of any strength or durability. But other more suitable materials are always at hand and in constant contact with it, and these it has the power to utilize as building material. The atmosphere as well as the waters is filled with carbonic acid, and protoplasm possesses the power under certain conditions to decompose this and to appropriate its carbon as the chief timber for the frame-work of organic tissues. This it doubtless does at an expense to itself whereby a portion of the matter of protoplasm allows itself to be seized by the oxygen of the carbonic acid for which its affinity is, under the given circumstances at least, less strong, and in this way the carbon is liberated. It has also the power to appropriate the ammonia from the air, the hydrogen from the water, and even various salts essential to organic structure from their respective solutions. Not only can it manufacture other organic compounds, but it can multiply its own mass by its immediate reactions upon environing ingredients.

It was undoubtedly in the sea, that great receptacle for all forms of matter, that the first beginnings of life took place. In the sea there now exist millions of beings of lowly organization whose bodies consist almost exclusively of protoplasm, either in its undifferentiated state, or but slightly modified into cells and simple aggregates of cells. And Nature, like the inhabitants of a new country, always uses for building purposes the class of materials most abundant and convenient to the region occupied. So we find that the chief timbers employed in the construction of marine creatures are lime and silica, which are extracted from the circumambient fluid. Thus the minute creatures that swarm at the bottom of the ocean are composed almost exclusively of a sarcode body incased in calcareous or siliceous shells, while the coral reefs are formed by the deposits of carbonate of lime from the bodies of gelatinous polyps. The extensive use of carbon as the framing timber of living organisms was not adopted until land forms, or at least partially aërial organisms, began to appear. The largest seaweeds, such as *Macrocystis pyrifera* which sometimes attains the immense length of four hundred feet, are plants of a low order, being composed entirely of cellular tissue, and propagating by a process little higher than mere conjugation.

Since protoplasm has so little power of organizing its own substance, the great desideratum was to find materials capable of sustaining it in its work of development. We have seen that the Rhizopods, sponges, and other low marine organisms, depend for the advance which they make beyond the condition of *Bathybius*, *Protogenes*, or *Amœba*, upon mineral constituents, such as lime, silica, etc. We have also had occasion to remark that *Bacteria* have been shown to be capable of assimilating purely inorganic matter, and out of this alone of multiplying their numbers at a prodigious rate. The substances out of which these latter thus manufactured protoplasm were the various salts of ammonia. That any strengthening matter was utilized in this case to sustain the protoplasm of which these simple organisms consist is not proved. But amid all the trials of nature, which are as varied and multiform as the forms themselves of matter, the most eminently successful one has been that of employing carbon as the frame-work of organization. All ends in nature as in art are attained by the use of appropriate means. The means in this case was *chlorophyl*. Chlorophyl is a substance existing in all true (not parasitic) plants, and by the influence of whose presence the decomposition of the carbonic acid of the air and waters of the globe can alone be effected. It is a product of protoplasmic activity combined with a certain degree of radiant energy, and these must cooperate under otherwise favorable conditions in order to insure its production. Chlorophyl never exists except under the influence of sunlight.* It consists of exceedingly mi-

* In Siemens's recent experiments, the electric light is claimed to have the power of generating chlorophyl.

nute grains of a green color and resinous consistency, which diffuse themselves through the substance of vegetable cells, and by their presence, aided by sunlight, the decomposition of carbonic-acid gas is effected and the manufacture of the carbonized secondary tissues of plants takes place. Chlorophyl may, perhaps, be regarded as the intermediate stage in the process of tissue-manufacture, which is always represented by a minute quantity in the transition state after the contact of the pure carbon with the cell-protoplasm has taken place. In that case it would be rather an effect than a cause, and the real labor of tissue-formation would then have to be attributed to protoplasm under the influence of sunlight.* The quantity of chlorophyl has been proved to be amazingly minute in proportion to the effect which it produces in imparting a green color to vegetation. The fact that it is itself uniformly generated by the application of sunlight to etiolated plants, while carbonic acid is decomposed under the same conditions, may sustain the assumption that the two effects are due to the same cause, without standing in any order of sequence to each other. To the optimist it may be regarded as a happy accident that the effect of the solar beam on protoplasm in contact with carbonic acid is to decompose this gas and deposit the carbon as strengthening material to the vegetal organism, whereby the vital energies of protoplasm are enabled both to undergo differentiation into numerous vessels and special organs and also to admit of integration into one compound and complex organization. But this is only one of the examples, of which organic nature is full, of the truth that organic evolution is the outcome of a struggle between the cosmic forces of concentration and dissolution, in which the former maintains itself by a resort to such artifices, whose overthrow the latter can only slowly accomplish. This seemingly remarkable coinci-

* This view, which ascribes to protoplasm the work usually assigned to chlorophyl, has recently met, in Pringsheim's researches, with a quite unexpected confirmation.

dence is, however, heightened still further when we remember within what narrow limits the phenomenon is confined.

Not all ethereal vibrations acting upon the protoplasm of vegetable cells are capable of decomposing carbonic acid. These vibrations, in order to accomplish this result, must have a certain wave-length, which represents but a small portion of the spectrum. The liberation of oxygen can not take place unless the ether-waves are as much as 0·0003968 millimetre in length, and the phenomenon again ceases when these waves become more than 0·0006866 millimetre in length. The wave-length representing the maximum effect has been observed to be 0·0005889 millimetre, which very nearly corresponds with the center of the yellow band. It also closely, but not absolutely, coincides with the point of greatest luminosity, falling the merest trifle below (toward the red end of) that point.

All true plants contain chlorophyl, or have once contained it; but botanists unite in referring to the vegetable kingdom many organisms, such as fungi, which do not come within this definition. The terms *animal* and *vegetable* have proved wholly inadequate to express the distinctions which, in the evolution of life, are found to exist. Belonging to popular language, and growing out of vulgar observation, these terms naturally serve only to distinguish the largest and most obvious classes of living organisms, and can not be expected to answer the needs of science. They should be superseded in science by others better adapted to express the real phenomena of nature. As popular terms they are useful, but as scientific terms they have already led to a vast amount of fruitless discussion in the vain attempt to refer all organisms to the one or the other kingdom, and to determine to which certain ones belong.

The fundamental distinction in biology should be drawn between those organisms which are capable of assimilating chemical or inorganic matter as the frame-work of their tissues and those which depend entirely upon the appropriation of matter already so manufactured. Organisms of the first class may be called assimilators, tissue-manufacturers, or autogens; those of the second are parasites.

The first class is further subdivided into three groups: 1. Those which manufacture protoplasm only, and consist entirely of that substance. This group includes, not only all purely plasson bodies, but all strictly unicellular organisms, such as *Amœbæ*, *Flagellata*, *Labyrinthuleæ*, etc., which contain no additional strengthening material. 2. Those organisms which possess the power to manufacture not only protoplasm, but also some form of shield, integument, shell, or other protecting armament or frame-work. To this group belong the Diatoms, whose protoplasmic cells are surrounded by delicate incasements of silica, and also the Rhizopods, whose shells are usually calcareous. 3. All organisms which possess the power of decomposing carbonic acid and employing the carbon (which is usually combined with oxygen and hydrogen to form cellulose, or lignine, $C_{18}H_{30}O_{15}$) as the strengthening material or frame-work of their tissues. Organisms of this group are always true plants in the popular sense, and contain chlorophyl.

The second class, or those organisms which have not the power of assimilating mineral matters, may likewise be subdivided into three groups: 1. Fungi, lichens, etc., which appropriate matters already manufactured by organisms of the first class (or, as in case of lichens, take them at third-hand from organisms of the same class), but which are not only fixed like plants, but are of low cryptogamic organization, and simple cellular structure. 2. True parasitic plants, whose organization plainly indicates that they have descended from chlorophyl-bearing plants, of which they are usually degraded types. In most cases these organisms have not differentiated so greatly from the ancestral form but that the family may be easily determined to which they belong, while they generally retain various foliar and bracteal appendages in the form of white, tawny, red, or brown scales, vestiges of the former leaves (*Orobanche*, *Monotropa*, etc.). As might be expected of this group, many intermediate links exist between the chlorophyl-bearing and the wholly parasitic state. *Viscum* and *Phoradendron* (mistletoe) have dull-green foliage, and contain chlorophyl, while they also appropriate the sap of the foster-tree ready manufactured. *Cuscuta* (dodder) begins life as a true plant, and climbs upon the contiguous vegetation until it finds an appropriate subject to which it adheres, and into which it intrudes its rootlets. From this time the portion below decays, while the upper portion continues to grow as a true parasite. 3. Animals proper, which live on the substance manufactured by the first class of organisms, either by taking it directly from plants, or by preying on other creatures of their own group which have derived their sustenance from plants.

It will be seen that only the third group of each of the two great classes attains to any high degree of organization, and that of these groups the great bulk of living things is made up. To these two groups of organisms the terms *plants* and *animals* have been applied by popular language, and their proper use is nearly confined within these limits. It is true that parasitic plants by degradation, and also fungi, are properly and correctly regarded as plants, but neither of the terms seems properly applicable to the two lower groups of the first series. The term *Protista*, employed by Professor Haeckel, embraces a field nearly commensurate with this definition, and, having been adopted by so high an authority, it ought to stand, unless superseded by a better one.

It is not claimed that any of these groups are so absolutely distinct that no transition stages can be detected. Such transition stages have already been pointed out between true chlorophyl-bearing plants and parasites by degradation. There are also a few cases in which chlorophyl was supposed to have been detected in what are properly animals, as in *Hydra viridis*, *Convoluta Schultzii*, etc., though a different explanation of the phenomena has recently been offered (*supra*, p. 340, note), while the mantles of certain Ascidians contain cellulose. But in so far as these facts exist, the creatures to which they belong are to that extent vegetable. In fact, there are some creatures which undergo metamorphoses such that they may be regarded as belonging to one group at one period of their existence and to another at another; and even true plants cease to assimilate the moment they are removed from the sunlight, though they continue to grow by the exchange and distribution of materials already assimilated so long as any reserve of these remains.

Again, all animals, even the highest, certainly do assimilate certain mineral salts and other strengthening materials, which are utilized in their skeletons and frame-work, and which they derive directly from the inorganic world. Certain animals also manufacture cellulose out of the materials existing in the cells of their tissues, while amyloid and saccharine matters in animals are no uncommon occurrence.

But there are two things which no animal, no fungus, no true parasite can effect, viz., the *manufacture of protoplasm* and the *decomposition of carbonic acid.* The former is a common function of the *Protista* and of plants, the latter of plants alone. These two (which I have extended into three) groups, therefore, constituting the first great class or grand division of organic life, embrace the only true *producers;* all the rest are simply *parasites* of unequal rank and dignity. It is, however, well worth observing that even in the fact that the higher forms of life are dependent upon the lower for the production of their assimilable matter, the universal law of aggregation, which we have steadily kept in view from the beginning, is again reiterated. The production of these assimilable materials is a form of aggregation, and in the development of organisms of a higher degree they enter again without decomposition as integral units. The process consists of a sort of chemical aggregation going on simultaneously with, and subordinate to, the higher physiological and morphological aggregation which determines the forms of the organisms themselves.

All investigation has thus far failed to reveal the absolute beginning of life on the globe. In fact, since life is simply the result of molecular aggregation, it is impossible to establish any exact line of demarkation for its absolute introduction. Any general theory of life must, if logically pursued, lead to the animation of all forms of matter. The most definite and convenient limitation is to predicate life only of those objects which contain protoplasm, and of that substance itself. What is really sought, therefore, by the empirical defenders of so-called "spontaneous generation" is, the origin of *organization*. Upon this question all that is as yet known is, that the spontaneous activities constantly going on in protoplasm tend to organization: first, through the individualization of definite portions of the substance; next, in the differentiation of a nucleus to these plastid individuals, transforming them into true cells; then, in the aggregation of a number of cells into a cluster or association, and the gradual more and more complete integration of this collective mass into a new unit or individual of the second order; and, after this, in various physiological and morphological differentiations of the lower units into various organs, vessels, strengthening timbers, etc., in which general process higher and higher orders of organization result. As the size and complexity of the organisms increase, means must be developed for carrying on the more and more complicated functions necessary to their existence. The process of assimilation must be seconded by the means of distribution, which is accomplished by the flow of sap, *i. e.*, of a liquid charged with assimilated matter. This is at first nothing more than a general diffusion of such liquids through the cellular mass, but in the highest plants it grows into an elaborate system of appropriate vessels. In all plants, and in proportion to the degree of vital energy, a portion of the carbon entering into the tissues is rendered effete, or in some way dropped from the combinations in course of formation, and, seized by the ever-present oxygen, is returned to the atmosphere as carbonic acid gas. This function, which is that of true *respiration*, is now known to be as universal in the vegetable as in the animal kingdom. The chief nutrition of plants consists in the assimilation of carbon and the formation of celluline or wood by its combination with oxygen and hydrogen, or perhaps directly with water, as the formula would suggest. But this form of nutrition is, after all, only the supply of strengthening material. Another form of nutrition is likewise going on at the roots, in which the quantity of protoplasm is increased by the contact of the ultimate cells of the roots with the matters contained in the soil, which must possess a certain proportion of nitrogen in some form, or the plant will perish. This may be regarded as the true process of nutrition. The other process is to the tree what the absorption of carbonate of lime is to the coral, and the trunk of the tree, as well as all its true woody fiber, may represent the polypidom upon which the animals live, and which they secrete from their gelatinous bodies.

In animals, too, there are constantly going on the two corresponding processes of nutrition, with this fundamental distinction (which applies, however, as well to all other parasites), that neither the strengthening material nor the protoplasm are manufactured by the organism which appropriates them. In all animal tissues there exists, in addition to protoplasm, a large amount of other matter whose function is to sustain the protoplasm and enable it to co-operate in all parts of the system. But for such materials no complicated organization could exist. Even the cells (and this is as true of plants as of animals) are many of them composed in large proportion of matters of a wholly different constitution from that of protoplasm, and contain only a minute portion of that substance in the free and active state. This serves as the vehicle by means of which the various alimentary solutions are transported through the tissues. But in large and complex animal organisms elaborate systems of vessels have been developed, without which the varied and here greatly complicated functions of circulation, absorption, secretion, and excretion would be impossible. In animals the proportion of protoplasm, or vital substance, to other matters is far greater than in plants, and all the vital functions are carried on with a correspondingly increased activity. The quantity of carbon set free from the tissues and seized by oxygen is therefore greater, and the respiratory function hence becomes a prominent one, requiring a complicated mechanism for its fulfillment. In animals, too, to a far greater extent than in plants, is the automatic activity which always resides in protoplasm itself transmitted by the mechanism of the organization to different parts of the organism or to the whole of it. This is accomplished by the massing together of cells containing a large proportion of protoplasm, and by the direct connection of these masses, by means of a differentiated tissue called tendons, with limbs or organs to be moved, the term muscle being applied to the masses of protoplasmic cells. Any change in all the cells of such a collection is capable of producing an effect upon the whole mass equal to the amount of change undergone by one of the cells multiplied by the number of cells.

One of the special automatic properties of all protoplasm, as seen in the manufacture of temporary pseudopodia by the moners, amœbæ, and rhizopods, is the power of contraction and extension. It is the former of these processes which exclusively characterizes the phenomena of muscular movement.

A further differentiation of the most delicate nature is found wherever a muscular apparatus exists, by means of which impulses or motives to the exercise of the former are communicated to them both from without and from within the system. This consists in all the higher animals of a complicated system of well-protected cellular threads, called nerves, highly charged with protoplasm, or consisting almost wholly of that substance, and connecting the muscular cell-masses with the surface of the animal's body, and also with all the internal organs. The slightest mechanical impact against the extremities of these protoplasmic threads communicates a shock to the cell-mass, or muscle, to which they lead, and causes its instant contraction. In nearly all cases this apparatus is compound, the thread of protoplasm leading first to a central mass or ganglion of the same substance, and then from this to the muscle to be affected. The simple movement of a limb caused by the communication of the shock of an external contact to the muscle connected with it is denominated a reflex action, and all muscular movements whatever are simply modifications and extensions of this same principle.

Organization, therefore, is simply an enlargement of the sphere of vital activity manifested by the vital substance protoplasm. Just as an organized army can accomplish vastly greater results than the same individuals that compose it could accomplish working independently, so the particles of protoplasm organized into an animal can produce far greater results than they could in the form of independent moners.

While the organisms of the first great class above designated are absolutely essential to the existence of those of the second, which subsist upon the products of their manufacture, and while the third group of this primary division furnishes the great bulk of the vegetation of the earth, without which it would be a dreary place indeed, and in which are combined so much that is useful, grand, and sublime, with so much that is beautiful, picturesque, and lovely, it is nevertheless out of the secondary or parasitic class, and out of the third group of that class, that the highest degrees of organization have been attained, and the true masterpieces of organic life have been carved. The former may be regarded as the primary or original products of organization, the latter as the secondary or derivative ones, but in the sense that whatever degree of organization has been effected in the production of the first is utilized directly in the production of the second class of organisms. The vegetable kingdom represents the first platform in an ascending scale of organization, starting from which, as a basis, the animal kingdom rises by additional progressive steps to the highest forms of life.

The extreme meagerness of this survey of the vast field thus passed over will perhaps be excused when the limited space available for such a discussion in this more general treatise is considered, but especially when it is clearly understood by the reader that the object is not to put forth a treatise on biology, but simply to find the proper place in a universal cosmology for the phenomena of life. Our object has been to connect this class of phenomena with those considered in the previous chapter, with a view to showing that all phenomena, however subtile or obscure, are the result of one universal process which may be called the process of material aggregation or evolution.

The central fact which it has been sought to impress is, that life is the result of chemical or molecular aggregation, which has for its product a substance whose properties are in fact the phenomena of life—in short, that life is a property of a particular substance called protoplasm, which is as truly chemical as is water or lime, and whose properties are as inseparable from it; that just as water may form into spherules or crystals under appropriate conditions, so may this substance by virtue of its properties develop living organisms.

Next in importance to this truth it has been sought to establish that above and beyond this chemical substance, endowed with all the essential properties of life, no other vital principle has yet been found to exist in any organism, however high in the scale, and that organization is nothing more or less than a device of nature, so to speak, for the extension of the powers of this vital plasma, by employing other materials, such as carbonate of lime, silica, carbon, and water, as the means of carrying this power into effect; that in this respect animals and plants are identical, and the only part of any organism that possesses automatic activity is the protoplasm contained in the tissues; that the protoplasm of plants is just as active as that of animals, and the appearance of fixity in the former is due to the stationary character of the supporting timbers and frame-work of the organism only, since in this way a higher degree of organization is attainable by this class of organisms. Not only is the protoplasm in plant-cells very active at all times, but in the functions of reproduction in all cryptogamic plants a portion of it becomes free and carries on independent operations in no respect different from those of an amœba or an infusorium. At this stage of their existence all distinction between animals and plants is effaced. The features which eventually distinguish them arise later and concern the mode of organization only, and not at all the vital principle. All life is one fact, which only clothes itself with different apparel, and manifests itself under varied forms.

CHAPTER V.

SECONDARY AGGREGATION.—(Continued.)

PSYCHOGENY *—GENESIS OF MIND—PSYCHIC RELATIONS.

Spontaneous motility the fundamental distinguishing property of protoplasm—Properties of matter in general—Phenomena of irritability and sensibility—Comprehensiveness of the law of impact as embodying the principle of force—Planes of stability in protoplasmic masses—Life *vs.* mind—Primary cause of the development of the psychic property—Where does feeling begin?—Definition of sensation—Consciousness implied in feeling—In what sense mind exists in nature—Genesis of nerves—Multiple individuality of the nervous system—Physiology of brain-function—Phenomena of psychology proper—Phenomena of the subjective branch of the mind traced out—Nature of the will—Phenomena of the objective branch of the mind traced out—Nature of mind.

In enumerating the different properties of protoplasm in the previous chapter, those of contractility and extensibility were specified. These properties are clearly reducible to one which may be defined as the power of any specific mass of protoplasm to change its form. This is the fundamental characteristic which distinguishes protoplasm phenomenally from all other substances. It belongs to all the plasson bodies from Bathybius upward, and also manifests itself

* John Fiske, "Outlines of Cosmic Philosophy," vol. i, p. 221. The remarks on the use of the word *cosmogeny* at the head of chapter iii are in the main applicable here. The genesis of mind is as much a fact as that of life, and as such should have a definite term to express the conception. (Since this note was penned, an article, by Professor Preyer, entitled "Psychogenesis," has appeared in the "Deutsche Rundschau" for May, 1880, but the writer confines it to what I may call the *ontogenesis* of mind instead of, as here, to its *phylogenesis*.)

throughout all organized beings, whether protists, plants, or animals, wherever protoplasm exists in them in a free state. Many cells are endowed with these automatic properties. Those found in the blood, in the nerves, and in the brain, and which consist of protoplasm in a nearly pure state, often so closely resemble certain independent moners as to have first excited the suspicion of being parasitic organisms. The germ-cells or unfecundated eggs of *Medusa*, *Hydra*, and other marine zoöphytes, which were found leading an apparently independent existence within the cavities of these animals, where they carry on the various functions of independent organisms, had long been observed and classified as internal parasites before their true nature was made known. The lowest plants consist of such cells, which become simply collected together in those a little more advanced, and, as the process of organization proceeds and definite structures are acquired, the condition of existence exhibited by the lowest is continued with every reproductive act—the primordial cells, now polarized into male and female, initiating each new organism by simple union, the same as when this was the final stage. Throughout the *Cryptogamia* the sexual differentiation is carried so far that, while the female or germ-cell (*ovum*) is outwardly passive, the male or sperm-cell (*spermatozoid*) is intensely active, and possesses a specialized form, frequently with several appendages. In the *Phænogamia*, the spermatozoids are represented by the so-called pollen-tube, which, under favorable circumstances, extends itself down into the ovary with such rapidity (*e. g.*, through the silk of maize) as to suggest the process by which pseudopodia are formed by the *Amœbæ*.

In animals, of whatever grade of organization, the male reproductive cell is an active animalcule, consisting of pure protoplasm, and endowed with all its life-like characteristics, while the female ova, both before and after fecundation, possess a greater or less amount of amœboid properties. All this is due to the fact that these bodies consist chiefly or wholly of protoplasm in which this automatic property resides, just as saccharine properties reside in sugar, or saline properties in salt. And just as the properties of all substances are due to the particular molecular activities which the substances possess by virtue of their molecular constitution, so protoplasm presents to us its peculiar phenomena because its molecular aggregates are composed as they are. The reason why these activities are so striking to our senses is, because they act upon masses of the substance so as to produce molar motion visible to our eyes. We are not surprised when a piece of alum produces a lively sensation upon the tongue and palate, although this is exactly as much the result of *activities*, *i. e.*, of the movements of molecules, as is the contraction of a muscle. But, as all other forms of matter except protoplasm affect our senses in this molecular way, producing only invisible motions, we do not realize that these effects are due to motions at all, and employ the term properties in a sort of ontological sense, scarcely distinguishable from that in which the alchemists expressed the phenomena of gases, which they regarded as immaterial spirits. The true *rationale* of the difference between the manifestations of protoplasmic activities and those of other substances is found in the higher degree of aggregation to which the molecules of protoplasm have attained. This was sufficiently dwelt upon in the last chapter.

We have now to consider to what this peculiar property of protoplasm naturally leads when organization affords it an opportunity to act upon large masses. So far as this affects the movement of organic bodies, this, too, has been considered in the previous chapter. What especially concerns us here is, not the power of protoplasm directly over other matter introduced as skeleton-work or stiffening-material for the production of molar effects, but the effect of the organization of protoplasm upon its own substance when suitably massed and organized for this purpose. Although we must suppose that the molecular activities of protoplasm are constantly going on, as are those of all other substances, independently of all external influences, still, as in the latter molar effects may be produced, a marked influence is felt in these by the contact of external objects. It is indeed doubtful, could such a supposition be made, whether any molar effects would manifest themselves but for the presence of such external agencies, and it is evident that the nature of the former is wholly determined by that of the latter. The tendency residing in a protoplasmic body to change its form, *i. e.*, to expand or contract any part of itself, and which is a property of the substance, due, like all properties of substances, to the molecular constitution of the substance itself—this tendency, which, for brevity's sake, we will call contractility, is always exerted in the degree and direction induced in the substance by the influence of its contiguous environment. The substance, as it seems, responds to all outside influences by corresponding changes of form. This phenomenon thus contemplated has been denominated *irritability.*

The phenomenon of irritability, as thus defined, and as observed to occur in living organisms, has been much discussed by eminent writers on biology, whose opinions need not be here reproduced in detail. They all agree, of course, that nothing corresponding to it occurs in the inorganic world, but it is needless to say that none of them have ever contemplated it from the point of view here adopted. It is not, in fact, true that no property is ever modified by the influence of external agencies. Every allotropic or isomeric form represents a modification of the properties of the bodies undergoing them, produced by certain external influences, and is therefore analogous to the changes of form undergone by protoplasmic bodies under like changed conditions. And the higher we ascend in the scale of chemical complexity of molecule the greater is the number of isomeric changes producible, and the more easily are they produced, until in protein we have thousands of such changes which appear to take place almost spontaneously. But we have seen that protoplasm bears, in this respect, something the relation to protein that this does to ordinary mineral compounds. The effects should be correspondingly higher in this same direction, and so we find them to be. This alone would be a sufficient natural explanation of irritability. It is as satisfactory as is that of allotropism or isomerism, and surely the biologist, in view of the more complex character of the phenomena of his department, should not be expected to furnish more exact explanations than the chemist.

But does irritability imply sensibility? Most writers, I believe, maintain that it does, and, as I think, logically. Lamarck, however, denied this, and assigned to this latter phenomenon an origin much later in the progress of organization. He regarded sensibility as a quality peculiar to those animals possessing a nervous system, and failed to state his belief in the genetic character of the nervous system. He argues as if all animals could be divided into two great classes, one of which possessed and the other did not possess a nervous system. If this were the fact, his argument would at least merit serious attention; but no one now believes that any such natural division exists, and those who would maintain that the particular attribute called sensibility belongs to higher and not to lower creatures, must show at what point it commenced to appear. Every thing now points to a strictly differential genesis of the nervous system. In fact, the nervous system is simply the organization of protoplasm, with which substance all vital phenomena originate, and to the organized and intensified properties of which they must all be ascribed. The nucleus of the highest nervous system is contained in the lump of protoplasm which moves about by the apparently spontaneous transformation of its gelatinous mass. Lamarck knew nothing of protoplasm. The cell theory of Schleiden and Schwann had but just been proposed, and, though quick to accept it, neither he nor any of his contemporaries had yet grasped its full import. He knew nothing of nerve-cells, or blood-cells, or brain-cells, nothing of spermatozoa or spermatozoids. He rejected the then infant doctrine of sexual organs in cryptogamic plants, and hence excluded the entire vegetable kingdom from the attributes of both sensibility and irritability. Such an authority, therefore, though a recognized pioneer in his department of science, is clearly without weight on the new and rising questions of life and of mind.

A close consideration of the phenomenon of irritability, or the modification of form which a protoplasmic body undergoes on contact with an extraneous substance, gives rise to the fundamental question as to why it does so; the true cause or *rationale* of the observed fact. This is to be found in the general law of impact, which, as has been maintained, underlies the conception of force. But, owing to the peculiar molecular constitution of the substance impinged and its great internal instability, a greater effect is produced than would be by the same impact against a chemically stable body. The molecules at the surface being disturbed, the equilibrium of the whole mass is overthrown, as when bricks are set up at short distances from one another, so that the fall of the first one will occasion the fall of the entire row. The fall in the case of the protoplasmic mass is, however, arrested on another *plane of stability*, and a different molecular state is the result; or, the molecules may be in such a state of *tension* in one state that a slight disturbance will carry the whole mass upward to a *higher* plane of stability. This would seem to be the case in contraction, the result being greater concentration; while, in expansion, the reverse is the case, and the molecular state suffers a species of degradation. By increased molecular organization these results may be rendered regular and definite, and such a condition would necessarily arise under the law of natural selection, where the regularity of the phenomena is required to secure the permanence of the individual aggregate. And on the same principle various modifications of this general character might be expected to take place, in the latter of which other more stable materials would be woven into the mass, and larger mechanical effects produced by means of them. That such is the true explanation of the origin of all tissues, of all the lower forms of organic life, and, extended to a far higher scale, of all animal movements whatever, has been already intimated. The most familiar illustration of this secondary form of irritability is to be found in the phenomena of muscular contraction.

Returning to the simple form, or irritability proper, as manifested in protoplasm itself and also in all organisms whatever, we must contemplate it from a new point of view. The simple motion of the molecules, which produces the change of form constituting irritability, is a purely vital phenomenon, and constitutes in the last analysis the sole fact in the idea of *life*. But this is also the point at which the phenomena of *mind* take their origin, and from which the departments of biology and psychology diverge. It is, indeed, also true that in the most abstract sense life and mind are but two sides or phases of one common truth. This truth is neither irritability nor sensibility, but the *molecular change* which underlies and occasions both. That we should not go further back and predicate life and mind of less complex aggregates than protoplasm, and indeed of all matter, I will not assert in opposition to the views of the greatest thinkers of the age. Indeed, I recognize the logical necessity we are under of doing this. The impossibility of finding any line of demarkation forces this admission upon us, and the phenomena of chemical affinities and molecular physics afford numerous justifications for the inductive establishment of the same conclusion.

While the phenomena of irritability are sufficiently manifest in the reactions of protoplasm as a chemical substance to be observed by ordinary scientific methods, the same can not be said of those of sensibility. As all psychic phenomena are removed one degree further from the access of our senses than are the vital ones, so we find the manifestations of sensibility in the fundamental organic substance one grade more subtile than those of irritability in this substance, and that there, as in the higher stages of organic development, the former must frequently be pursued by the aid of reason where the latter may be made accessible to the organs of sense.

Do the lowest organisms feel? This is the fundamental problem of psychology. That the substance of their bodies reacts to the influence of certain stimuli no one doubts, but is this anything more than is embraced in the notion of irritability? It seems to me that this term has been very happily chosen to express this phenomenon, and that in choosing it Lamarck has "builded better than he knew." He has defined it as "la faculté que possèdent les parties irritables des animaux de produire subitement un phénomène local." Although not the first to use the term, he was, perhaps, the first to define it, and in his definition all idea of consciousness on the part of the organism of this "phénomène local" is carefully excluded. He further alludes to the remark of Cabanis,* "that sensibility and irritability are phenomena of the same nature and have a common source," for the purpose of combating it. Nevertheless, the term irritability, in its common acceptation, as well as in its proper etymology, implies feeling, and it is hard to define away this implication. It is fortunate that such is the case, since every attempt to separate the mere mechanical operations of the least organized beings from the notion of a conscious sense of the objects they are to attain is in the direction of Descartes's exploded theory that all animals are automatons.

What, then, is sensation?

It may be defined as *the conscious susceptibility of a substance to the impressions made upon it by other substances*

* "Rapports du physique et du moral," vol. i, p. 90.

brought into contact with itself. The only qualification which this definition requires is that, when the feeling is wholly internal, portions of its own mass producing them must be objectively conceived, as if external. It may then be asserted, without qualification, that every manifestation of the phenomena of irritability is necessarily accompanied by the phenomena of sensibility.

The great mystery of the universe is not life, but mind; for, while the progress of science has dispelled all the ontological conceptions of life, and furnished a rational and intelligible theory of all its phenomena, it has not yet offered a solution of the question of the essential nature of psychic effects. Nothing is explained until it can be reduced to the movement of matter in some form. Vital phenomena can be so reduced, and may therefore be regarded as explained. But how can feeling be brought under this canon? It is easy enough to understand how material contact can produce the phenomena of sensation in a being presupposed to be endowed with that attribute, but how is the attribute itself to be explained? and what is the essential nature of feeling itself? If it is the result of a mechanical change, what is the nature of such change, and how does it differ from all other changes? To those who believe in force and energy as entities distinct from matter, these questions are easily answered. Mind is a form of force. But the ease with which such answers are given only serve to remind us of the equal ease with which our ancestors answered, and all savage races still answer, all the questions about which science is most sorely puzzled. Force itself and energy must be explained. This has not yet been satisfactorily done; and why? Because they have not yet been reduced to terms of matter and motion. The school of dynamists can not be allowed to introduce these entities, and ingraft them permanently upon philosophy. The causality of the age and of future ages will seek to go below them. All phenomena must ultimately be brought under two categories, matter and relation;

and every attempt to arrest the course of philosophy before it reaches this basis will be eventually overcome. It is as logical to make mind a category in itself as to refer it to any other category. But it is not logical to do either.

We have seen that life is a property of matter, strictly analogous to all other properties of matter, and that all properties of matter may be explained on strictly mechanical principles in terms of matter and motion—that they are the mechanical effects of the motions of the molecules of the substances manifesting them, and differ as the degree and mode of aggregation of those molecules differ. That we do not know more about them is because the molecules are so small as to be far beyond the limits of our organs of sense, which, being composed of matter of much larger molecules than those of most other substances, can not be expected to be capable of directly perceiving such inconceivably minute objects. What we know about them we have inferred by the exercise of reason from some of the grosser manifestations, which either come or may be artificially brought within the range of our faculties.

If we declare, as we logically must, that the phenomena of mind—all of which, like those of life, are, as we shall see, derived from the simplest form of feeling or sensibility—are the result of molecular activity, although we thus place them upon the same general footing we are nevertheless compelled to confess that the attempt rationally to grasp the conception is accompanied by far greater difficulties.

Underlying the idea of feeling, and embracing it, is the more comprehensive idea of *consciousness*. Without attempting to follow or dissent from the opinions of the purely metaphysical school, it may be asserted with safety that no sensation can exist without a consciousness of it. Taking the common acceptation of those terms, such a proposition would involve a contradiction. The essence of sensation is consciousness. The real problem is, therefore, how matter is rendered conscious. If we were endowed with faculties with which we could penetrate a molecule of protoplasm, and note the manner in which it is compounded and the motions described by its components, and by the components of these components, we might then have hopes of one day discovering the exact configuration and composition required to awaken in such molecule a consciousness of the presence and impact of another molecule; or, if we failed to detect such a property in a single molecule, we might learn what amount of association of such molecules into a mass was sufficient to make this property perceptible. For the mere massing together of homogeneous molecules is a form of organization, and the primary form of all organization. And any property which becomes manifest after any given degree of organization may be safely inferred to have existed in the molecules prior to such organization, but in so feeble a form as to escape observation. The gulf which separates the manifestation of vital force in Bathybius and in an eagle is as wide as that which separates the manifestation of psychic force in an amœba and a Cicero. But this difference must be accounted for in both cases by the degree of organization, by which low and feeble activities are immensely magnified and intensified through purely mechanical devices.

The property of consciousness must therefore be assumed to inhere in every molecule of protoplasm to a certain limited degree, which in certain definitely shaped masses becomes so far increased in intensity as to be inferable from the actions of such individualized portions of the substance. From this simple state increment is added to increment throughout the whole course of organic development, until the highest manifestations are reached. Conversely, we are compelled to predicate of each component of a protoplasmic molecule some trace of the same property, which is the proper basis for the theory of a universal soul in inanimate nature. It exists, but for want of organization it is too feeble to be perceptible to the human faculties, or to work any appreciable effects. It is thus that science at length agrees with vulgar opinion as to the existence of Mind in Nature; but there remains this fatal difference, that instead of magnifying it into omniscience, it reduces it to practical nescience, and declares that increase in mind-force can only take place in proportion to increase in organization. And while molecular or chemical organization may so far intensify it as to render it perceptible to the human faculties, molar or morphological organization may carry it up to the exalted height to which it attains in the *élite* of mankind. The only intelligence in the universe worthy of the name is the intelligence of the organized beings which have been evolved, and the highest manifestation of the psychic power known to the occupants of this planet is that which emanates from the human brain. Thus does science invert the pantheistic pyramid.

The consciousness of effects is the quality which constitutes the essence of sensibility and of mind, and to define it further would require a knowledge of the molecular changes adequate to produce it. It is a difficult conception, because mind can not readily conceive the mechanical causes of its own operations. It is rather the awkward attitude in which we stand to the phenomenon than any inherent difficulty in the phenomenon itself that renders it impossible to convey to the mind a clear conception of what it is in its most simplified condition. It is not different in other respects from all other properties of matter. We can easily conceive how the particular activities of the molecules of a given quality of wine should be the cause of the effects produced by it upon the tongue, palate, and lining of the stomach, but no adequate conception can be formed of what those molecular activities actually are. It is not otherwise, in the last respect, with the conception of a piece of conscious matter, but neither can we well conceive, as we can in the other case, that any such activities should result in such a property. In the one case the property itself can be tested by sense, in the other no such test is applicable. We can not conceive of our minds as the result of organized matter. Yet, if candid, we must admit that they are just this; for, if our brain were reduced to sixty-five cubic inches, or deprived of the delicately organized tissues of vessels and nerve-matter of which it is composed, we should be idiots instead of rational beings.

The phenomena of life and those of mind may be properly regarded as the obverse and reverse of one and the same truth. Irritability, according to Lamarck's definition, is simply the motor effect. Sensibility, on the other hand, is the corresponding sensor effect. The former we *perceive*, the latter we only *infer*. This is why the term irritability has acquired both senses, which cling to it so persistently that it becomes difficult to conceive of irritation without sensation. On the other hand, so natural is it to infer feeling and even thought from any form of action or motion whose immediate mechanical cause is not apparent, that we are apt to style an object *sensitive* because it is observed to have such movements, although there may be a presumption against its possessing any proper feeling. This is the case with "sensitive-plants," very few persons believing that they act from real sensation.

Vital and psychic phenomena are certainly too intimately connected and interwoven to be separated in discussing either, and it has therefore been customary to embrace both under the last-named term, so far as their abstract consideration is concerned, and to confine the term "biology" to the treatment of the facts of morphological and physiological organization. In the preceding chapter, however, the phenomena of life have been isolated as far as possible, the chief object being to furnish a rational or mechanical explanation of them. The present discussion is, therefore, simply a continuation of that just closed, with a view to carrying it up a step higher in the ascending series of co-ordinated relations.

We have already seen that all psychic phenomena are either motor or sensor, the former of which are perceived, the latter inferred, from our own constitution. When we see other creatures perform those actions which we believe to be due to sensory experiences, we make this inference solely by virtue of this faculty in ourselves, and leave it to reason alone to determine how far it shall be carried. While some carry it to sensitive-plants, to the least organized animalcules, to nerve-cells and sperm-cells, and even to chemical molecules of inorganic substances, others, like Descartes, deny it even of the highest animals. It is at best a species of anthropomorphism, by which we conclude that other things are like ourselves in proportion as they behave as we do. Since it is from motor effects that we can alone judge of sensor effects, it is by the study of the former that all our knowledge of the rudimentary manifestations of mind in the universe can be acquired. This is a strictly scientific line of inquiry, and has already been successfully prosecuted until a flood of light has been shed upon this most important of all human problems. Since science has attacked this problem from this its only legitimate side, the metaphysician's "occupation's gone," and the world now looks to science alone for its ultimate solution.

Nerves are mechanisms for the organization of the properties of protoplasm. A nervous system is a mechanical arrangement through which the motor effects of this vitalized substance are, as it were, "geared up," and thus intensified to the required degree for conducting the functions of the organism endowed with it. A brain is to a lump of protoplasm what a high-pressure steam-engine is to a cloud of vapor, or a Ruhmkorff coil to a pith-ball. These are not mere analogies, they are practical illustrations of the mechanical way in which these forces are intensified by the process of organization. Chemical or molecular organization produces a substance possessing vital properties strong enough to be detected by the human faculties. Morphological organization continues these effects to the highest point reached in the organic world. Psychic phenomena go hand in hand with vital phenomena, and are inseparable from them. Protoplasm is the "physical basis of life." It is also the physical basis of mind. It *constitutes* the nerves. Everything else connected with them is *apparatus*. A nerve consists of a chain of cells inclosed in a sheath and extending from one part of the organism to another. In the lowest and least differentiated organisms there are no nerves. The creatures are *all nerve*. The impulses pass through the substance of their sarcode bodies and communicate the impressions received with sufficient force and precision for their simple habits of life. As the process of morphological aggregation advances, protection is required for so large a group of units, and this is supplied by natural selection in the form of a frame-work or skeleton of a differentiated material of one kind or another. This is incipient organization. Still later the economic effects of natural selection tend to increase the quantity of the strengthening materials until it far exceeds the quantity of vital substance. This becomes distributed to different parts of the system and co-ordinated by means of special channels. Thus the same quantity of vital force is capable of producing vastly increased effects. This diluting process begins in the cell, which eventually comes to contain no more free active protoplasm than is found in Mohl's "primordial utricle," which is usually found in active operation within the inner lining of the cell-coat of plant cells. In animal cells the proportion of pure and active protoplasm is usually greater than in plants, but differs widely in different tissues. In the nerve-substance itself, and that of ganglia and of the cineritious brain-substance, the entire cells consist chiefly of pure, living protoplasm. In the muscles the amount is greatly diminished, but sufficient is retained to perform the functions of muscular contraction which constitute the principal lever of power employed by the animal economy. All parts of the organism are *integrated* by means of channels or tracks of protoplasm in the form of nerves, along which constant communication may be kept up among them. In the very lowest animals, as in the Protozoa, Zoöphytes, etc., these channels are rudimentary, and not anatomically distinguishable from the surrounding parts. Motor and sensor impulses are set up in the general tissues, which pass along through certain parts more frequently than through others. Such tracks soon become lines of least resistance, and every additional repetition diminishes the resistance and specializes these parts of the tissue as the channels of communication. The manifest advantage of this change tends to continue the differentiation, under the laws of direct and indirect equilibration, until the degree of specialization assumes the nature of a true nervous apparatus.

In all the more highly organized forms of life the process is twofold. The impression made at the exterior is communicated through a more or less completely developed nerve, by the actual successive alteration of the state of its molecules, to a less differentiated protoplasmic mass in the interior, which receives the impulse by a similar alteration of all its molecules, throwing it into an unstable condition, from which it immediately returns to its normal state by means of a discharge along a second line leading to some organ of locomotion, and terminates in a more or less completely developed muscle. The molecular change communicated to the second nerve is transferred to the cells of the muscular substance, which contract in response to the nerve-vibrations, drawing with them, by means of a firmer tissue attached to them, the limb or organ to be moved. From the act of putting forth pseudopodia, improvising mouth, stomach, and other organs, and performing general amœboid movements, to that of regularly transmitting a motor impulse by means of true nerves, the animal world presents every conceivable shade of transitional gradation. The nerves leading from the periphery to the interior mass of protoplasmic matter are denominated afferent nerves; those leading from this interior mass to the muscle to be contracted are called efferent nerves. The interior mass is itself styled a ganglion, and the entire process resulting in the required movement is what is known as a reflex action. Reflex action may take place in individuals of the second order, but not in those of the first. But in individuals of the second order the individuality of the cells is only so far lost as to be co-ordinated into a compound aggregate. Each cell still acts and feels for itself, and maintains its individuality within the higher individuality.

The next step in the development of a nervous system is to co-ordinate two or more of the simple systems described, which are capable of reflex action, into a system of a higher order. The several nerve-centers or ganglia of the simple systems are connected by a third kind of nerve called a *trunk*, and all acquire a certain degree of dependence upon one another and upon the whole, acting as a unit. This stage is beautifully illustrated by the *Annulosa*, within which group all grades of the development may be found, from that in which there is simply *co-ordination* of a very feeble degree, all the ganglia being apparently equal, to that in which this co-ordination is accompanied by a more or less complete *subordination* of all the rest to one of larger size and greater power. This one which thus assumes control over the entire series may be called the *brain*, although that term is generally confined to the *Vertebrata* in which it is incased in an osseous frame-work and protected from injury. Although between the *Invertebrata* and the *Vertebrata* there are morphological differences, which it would be important to note if we were contemplating the subject from that point of view, nevertheless there are no strictly qualitative physiological differences, and this is our present point of view. In the vertebrate, as in the worm or the insect, we find a compound nervous system such as above described, only in the latter the co-ordination becomes more complete, while the degree of preponderance of the principal ganglion is far greater. But in both these respects, and particularly in the latter, there is great progress among vertebrates, from the acranial lancelet to man. And yet neither the degree of coordination nor of subordination is ever so complete but that parts of the system may, under the proper circumstances, be found acting independently, as if belonging to a lower stage of the development.

The actions of the highest vertebrate may be classed under two general heads: 1, those which are performed by the exercise of the nervous system in its integral capacity; and, 2, those which call into exercise only one or more of the subordinate simple systems composing it. This second class of actions is the physiological explanation of all involuntary and habitual actions, and opens up a subject of the utmost importance, which has already been referred to in our consideration of Herbert Spencer's "Principles of Psychology," in which work it is also treated. What it especially concerns us to note here is, that each simple system within the most complex one maintains a certain degree of its original individuality, and in so far is to be regarded as an integer. When this fact is fully comprehended, most of the difficulties which now perplex the students of mind, arising out of the numerous so-called "unconscious" actions, will disappear. We must not only iterate the truth which biology has now so plainly taught us, that we are made up of many distinct individuals integrated into an organic unit, but we must actually believe and realize this truth. The compound unit thus formed by the integration of simpler ones may properly enough be called the *ego*, but it must not be forgotten that each of the simpler units is also in itself an ego, and performs its own psychic and vital functions independently of the general ego in all cases where it is not necessary to appeal them to that tribunal. Over all the so-called "vegetative" functions the brain sits in serene unconsciousness. It can not allow itself to be drawn upon for the incessant supply of the physical force required to carry on these operations. Every *new* duty is attended to by the whole or supreme ego until its repeated performance renders this waste of nerve-tissue unnecessary, and these impulses are remanded to the subordinate ganglia. But these subordinate egos are not the senseless, unconscious things which they are supposed to be. They are conscious individualities, whose feelings we do not appreciate because they are *not our own.* The only ego we know any thing about is the supreme one. This is the person thinking and feeling. But, if the subordinate simpler egos could also express their feelings, they would tell us of pains and pleasures of which *we* are ourselves ignorant. And it must not be supposed that these sensations, emotions, and thoughts are so feeble in their intensity as to be unworthy of serious consideration. Numerous cases are on record in which pains and emotions of the profoundest character must have been experienced by the lower centers of which the supreme ego was wholly unconscious. It is probable that this is the true explanation of those struggles which patients make who are undergoing painful operations under the influence of chloroform. The drug paralyzes only the highest center, and leaves the lower ones to suffer as if it had not been administered. And these sufferings are as real as if they had been undergone by another person, or an animal whose feelings the patient could not share. It is, therefore, the practice with competent surgeons to continue the administration of the anæsthetic until all the subordinate centers except those presiding over the essential functions of circulation and respiration are fully under its influence, when operations may be performed without danger.

But this is not all. The brain itself is a compound organ, and it is a daily occurrence that prolonged and rational trains of thought are carried on wholly without the knowledge of the integral organism. The cerebral lobes themselves, from whose molecular changes have emanated the most profound results which the materials of this planet have evolved, constitute subordinate egos or individual identities, and their operation is often clearer and deeper when untrammeled by the multitudinous side-issues which accompany their co-ordination with the sensorial center. Herein is the complete explanation of the much-discussed phenomena of "unconscious cerebration." The same principle also satisfactorily accounts for the strange feats of somnambulism and hypnotism so numerously recorded, as well as for all cases of so-called "double-consciousness" resulting from epilepsy and undue excitement. In fact, it seems to me that the greater part of the mysteries and marvels of mind become greatly simplified, if not completely reduced to the strict rules of science, by the simple recognition of the multiple character of organic individuality, as is shown by the process of evolution itself.

The class of actions in which the sensor impulse which gives rise to them is not carried to the highest center and not co-ordinated with the whole nervous system is still further subdivided into a series of classes, according to the number of subordinate centers to which it is carried, and the nature of the resultant action is proportionally removed from simple reflex action. All afferent nerves do not arise at the periphery, but many take their origin along the alimentary canal and at other points in the interior. It is by means of such comparatively independent internal systems that all the vital functions of circulation, digestion, secretion, excretion, etc., are carried on, and of these the integral system is rarely, or never at all, apprised. What has been called by metaphysicians "the consciousness" is, the consciousness of the highest center. As all other centers of the compound system are subordinated to this one, when it becomes itself conscious of a change at any point in the body, the whole organism is said to be conscious. This consciousness, *par excellence*, is not, however, the only consciousness. In the highest vertebrates, owing to the vastly greater size and complexity of the supreme center as compared with any of the subordinate ones, the consciousness of this center is regarded as that of the organism, and no account is taken of the consciousness of the lower ones. But in animals of far lower organization, as in the tape-worm, the consciousness of the lower centers is nearly equal to that of the highest; and, if by chance a physical disunion of any of the somites is made, each becomes supreme and soon produces others. Many animals may be cut in pieces, and each piece will survive and ultimately reproduce its kind. The law is well established that the degree of dependence of the parts upon the whole is proportionate to the distinctness with which the systems are constructed, and subordinated to the highest system. In other words, the degree of integration is proportional to the degree of differentiation. In the highest mammalian forms, and especially in man, the gulf between the highest center and the lower ones becomes so wide that it is no wonder that the individuality of the latter should have been wholly ignored, but this has led to many errors in the study of the mind which its recognition removes.

The supreme consciousness of the entire organism consists, as already remarked, in the continuation of the molecular change, set up at any point in the body, along the general nerve-trunk, from ganglion to ganglion, until it reaches the supreme center and produces a corresponding change in the molecules composing it. This renders this center conscious of the same impression of which the subordinate ones had been made conscious, and this unison of consciousness along the entire line constitutes the state which is termed, *κατ' ἐξοχήν*, *consciousness*. But many of our highest physical operations are carried on without such complete co-ordination, of which those of standing erect and of walking are among the most important, and must require the necessary impressions to be referred to the highest ganglionic centers of the spinal cord and *medulla oblongata*, and, as some believe, to the cerebellum.

The organ of supreme consciousness, as all now admit, is not the cerebral lobe, but that tract at the base of the brain which constitutes the true termination of the spinal cord, and which has received the name of *sensorium*. The brain itself is simply a modification and specialization of the principal nerve-trunk of vertebrated animals. This is located along the dorsal region of all animals of that type, and, after reaching such as possess a true osseous spine, it is found inclosed by processes of this, which are adapted for the purpose. Just as the brain-substance is a continuation of the spinal cord enlarged and remarkably modified, so is the skull, within which it is securely incased, a like modification of the spinal axis correspondingly enlarged and specialized to accommodate it. The various steps of this development may be traced with considerable clearness, not only in the lowest vertebrate forms from amphioxus to the fishes, but also in the embryonic changes which the highest forms pass through according to the remarkable law already stated (*supra*, p. 340).

In the study of these transitions, whether phylogenetically or ontogenetically, it is found that the cerebral lobes, whether anterior, lateral, or posterior, must be regarded as comparatively new and superadded structures, having no necessary existence so far as maintaining the life of the animal is concerned, but designed to increase the power of co-ordinating the impressions or states of consciousness of the highest, or sensorial, center, so as to produce what is understood by the term *thought*. These cerebral lobes are not centers in any proper sense of the term, although they may contain partial systems within themselves. They are rather in the nature of receiving and transmitting surfaces for a special class of impressions. They are analogous to the nerves of the special senses, such as the eye. The retina, spread over a large surface for the purpose of receiving a special class of impressions, may be compared to the *cortical layer* of the brain, in which the chief power seems to reside. This becomes the reservoir of a greater and greater amount of force in proportion as its superficial area is increased, and to effect this the "convolutions" are developed which in the human brain largely contribute to this object. The cortical layer is connected with the sensorium by means of special nerve-fibers which traverse the substance of the brain-mass and terminate in the two pairs of bodies belonging to the sensorium, which are called respectively the *thalami optici* and the *corpora striata.* Those connecting with the former, which lie a little behind the others, are believed to be chiefly ascending fibers, and those connected with the latter, chiefly descending fibers. The ascending fibers are supposed to convey the molecular changes undergone by the sensorium in response to various impressions, and which constitute states of consciousness, to the cortical layer, in which a corresponding molecular change takes place, constituting a more or less permanent impression. The descending fibers are calculated to convey to the sensorium impressions experienced by the cerebrum, and are therefore strictly analogous to all other afferent nerves.

The rapid circulation of the blood through the brain-mass, and particularly within the cortical layer, has the effect constantly to excite its delicate tissues into action the same as the contacts of external objects excite the sensitive peripheral nerves of the body. This perpetual excitement of the impressible substance of the cortical layer, with its complicated folds, tends to keep alive the impressions made in it by the action of the sensorium as conveyed by the ascending fibers. The substance of this portion of the brain is so specialized by the action of natural selection that the slightest impulse received from the sensorial center is not only distinctly felt, but so deeply imprinted upon the brain-tissue that it remains for a great length of time, or during life. The process of nutrition, which is constantly going on from materials copiously supplied by the blood, does not obliterate these impressions, but acts after the manner of the calcareous or siliceous particles in the process of petrifaction, and, while rapidly renewing the actual matter of the tissues, preserves the form with the utmost fidelity. As the general experience of the whole body is constantly producing new states of consciousness, which are each in turn transmitted to the cerebral hemispheres and stamped upon the cortical layer, the incessant flow of the blood arouses the older of these into action along with the newer, and so commingles them into simultaneous activity that they are necessarily compared and contrasted. The several harmonies and discords thus produced are the fundamental elements of thought, and, whenever they become sufficiently vigorous, they discharge themselves along the descending fibers to the sensorium, which sends them out in the form of motor impulses to the muscles whose contraction will produce the action demanded by the thought, or to emotional centers in the form of painful or pleasurable states of mind. The transmission of a state of consciousness from the sensorium to the cerebrum and the impression which it directly makes upon the latter organ constitute an *experience.* The revival of such an experience by the action of the blood, in rapidly circulating through the particular tissue upon which the impression was made, constitutes a *remembrance.* *Thought* may be defined as the *comparison of experiences and remembrances.* But as remembrances are nothing more than revived experiences, which do not on this account at all cease to be experiences, it would seem equally proper to define thought more generally as the *comparison of experiences.* Reflection is that form of thought in which all the experiences compared are revived or remembered experiences, and most of the serious thinking which is done by mankind is of this character. Although there is reason to believe that portions of the surface are specialized for the reception of particular classes of impressions, still there doubtless exists a more or less complete system of fibers whose office is to connect all such localized parts with one another, and perhaps to refer them to subordinate centers before their final transmission to the sensorial center. The existence of some such fibers has long been known, such as the commissural and inter-cerebral fibers, the former of which constitute the *fornix*, while the latter connect the cortical layers of the two hemispheres by means of the *corpus callosum;* other subordinate ones also exist.

The above constitutes the purely physical explanation of the fundamental phenomena of the mind, from which all the psychic manifestations, whether of animals or of man, are directly derived, and to which they may all with greater or less distinctness be traced.

Just as we have seen that vital and psychic phenomena are but the two sides of a single truth, so we shall now see that the phenomena of sense and those of intellect are likewise but the obverse and reverse of one and the same coin.

The common origin of sense (*Sinnlichkeit*) and intellect (*Verstand*) was taught by Immanuel Kant, than whom no philosopher has penetrated deeper into the purely phenomenal or psychological problems of mind.

This fundamental distinction here foreshadowed rises immediately out of that which subsists between subject and object. Sense may be defined as the subjective, intellect as the objective, side of mind. Neither is, however, in any degree independent, but together they constitute simply the two points of view from which the same phenomena are contemplated. Sense, indeed, "gives us the object"; but this object is the initial unit of intellectual operations. The true antithesis to the object is the immediate consciousness of the subject. The process is made clearer when, instead of the *things*, we consider the *actions*. The act of becoming conscious of the contact of an object is properly denominated *sensation;* the act of recognizing the object is called *perception.*

Sensation is the consciousness of the change which the contact of the object effects in the state of the molecules at the point of contact. This bears no direct proportion to the amount of disturbance produced, but depends far more upon the degree of *sensitiveness* of the part affected. This sensitiveness is due to the specialization of the tissues for this express purpose, which results from the operation of natural selection or adaptation. The physiological meaning of these degrees of sensitiveness in different tissues is, that the nerve-fibers are so arranged at points where it is advantageous to the organism to have them so, that slight disturbances at their termini convey comparatively powerful discharges to the interior centers, and the greater the disproportion between the amount of disturbance and the amount of the discharge the more sensitive the part is said to be. The contrast between the degree of sensitiveness of the ends of the fingers and the back of the hand is the most familiar illustration.

Perception is the quality of that state of consciousness of the tissue affected, which arises from the character of the object; it is the result of differences of sensations produced by differences of objects; or, still more clearly, of different sensations caused by different objects. It will be seen that perception involves plurality. It also involves comparison of differences in the effects produced by differences in the causes. But, when we speak of objects as causes of sensations, we mean, of course, the properties of these objects. Not only do all different objects have different properties (else they would be the same), but every object has many different properties. It is the different states of consciousness induced by the simultaneous effect of several different properties in the same object which determine the identity of that object, and give us a clear perception of it. The action of a single property, could such a thing be conceived of, would produce a sensation, but it would result in no perception. There would be no data furnished for arriving at any of the properties of the object, unless it be that of resistance, and no other idea of the object could be formed. But not only do we always receive a multiple impression from the plurality of properties of all bodies, but this multiplicity is still further multiplied by a similar plurality in the sensitive mechanism. In every part which has been at all adapted (specialized) for receiving impressions, the number and proximity of the nerve-fibers leading to it—or, rather, from it—are so great that no object large enough to produce a molecular change at all could escape coming into contact with several such fibers. The several distinct sensations thus produced are instantly referred to the higher centers, where they are co-ordinated and compared in something like the manner in which it has been described as taking place in the brain. This comparison of a multiple impression transmitted through a multiple channel furnishes the data for a perception of the object. This perception is in the nature of a judgment as to the character of the object itself. All the lower nerve-centers, and the afferent fibers themselves, also co-ordinate actual impressions with previous ones still remaining, as in the case of the brain; and from this source still more extensive data are derived for the formation of a distinct perception of the nature of the object.

Perception of the lowest form consists in the impression thus made by the object upon the afferent nerve and the ganglion, to which it immediately leads. That animals, which have no other nervous system than this, perceive in some sort of rude manner the nature of the bodies with which they come in contact, there can be no doubt. Perception alone has no reference to motor action. It is strictly passive in its character, and, although the molecular change set up by the contact may cause a motor impulse along the efferent nerve and an action on the part of the organism, the perception itself, abstractly considered, is a passive phenomenon. It is simply the recognition by the sensitive nerve-matter affected that it has been thus affected, the manner in which it is affected denoting the properties of the object. This is the root of the idea of *knowledge*. In thus recognizing the properties of an object, the nervous system, however simple, in so far *knows* the object. The term *cognition* is preferable to recognition, since it does not presuppose an antecedent acquaintance with the same properties. In this sense we shall use this term with the corresponding verb *cognize*, the meaning being substantially the same as that assigned to it by the later metaphysicians.

The power of cognition, or the capacity to acquire knowledge of objects, is the essential quality of *intellect*. This term is not generally applied to any but advanced organisms, and has probably been thus far confined to man. But the human intellect, whether we take that of the Bushman or of the Teutonic sage, is only an amplification of this power or capacity which resides in the lowest organized beings. When additional centers are developed and the rudiments of a brain appear, the impressions are carried up along the nerve-trunks, stamped upon the intermediate ganglia, and finally referred to the sensorium. If there are as yet no cerebral lobes, this is the terminus, and the entire system is thrown into a state corresponding to the qualities of the object with which it has been brought in contact. The entire organism having been built up by infinitesimal modifications which have been made to adapt it to its environment, *i. e.*, to similar contacts, it has already registered all such influences previously experienced, and can instantly refer the latest one to some category already well established, as being similar to such and such influences previously received.

Not only immediate actions but gradual modifications of structure are determined by the advantage or disadvantage of the existing conditions as regards new impressions. The manifest advantage of an increase in the power of distinctly cognizing the properties of bodies brought into contact with the organism, both with a view to appropriating and to escaping such objects, tended to the introduction of means for increasing this power, and the chief modification of structure undergone for this purpose was the development of the cerebral lobes. The power of cognition depends upon the degree of co-ordination of data rendered possible by the structure of the organism. This co-ordinating power in turn depends upon the quantity of organized nerve-tissue, and more especially upon the amount of *surface* of this tissue suitably adapted for the reception of impressions. The development of the cerebral lobes admirably fulfilled this office and increased the power of cognition. A theory of the manner in which perceptions and all kinds of impressions are referred to, and compared by, the cerebrum, has already been given in the present chapter (*supra*, p. 373). Where such operations are confined solely to the impressions made by external objects, they may be regarded as strictly intellectual, and the same is true no matter to how great an extent the process of comparison, abstraction, generalization, or classification may be carried. Any object whose qualities have ever impressed themselves upon the mind in the course of its experience may be legitimately recalled and brought into juxtaposition with an actual or present impression, or may be compared with any other old one at any time or to any extent. The process thus described is *thinking*, and the object of all thought is truth. Should this theory be reproached with ignoring the part which is performed by relations in the operations of the thinking faculty, it must be replied that the properties of the bodies from which are derived the data of all thought are only relations, that sensation which renders the perception of these properties possible is itself a relation, and that all the operations of the brain are performed in adjusting relations thus communicated to it. The objects are certainly not there, only the impressions which their activities have made upon the plastic tissues of the organ of the mind are immediately concerned, and although these impressions are real, material facts, as are also the objects which have directly or indirectly produced them, still the entire process has for its result the determination of the relations which these impressions sustain to one another. In short, the thinking process is one of *representation.* It is this fact, wholly unavoidable as it is, which renders *error* possible. In sensation we have the origin of feeling, in perception that of thought. Let us follow out these two primary branches of psychic phenomena in a somewhat more careful manner.

Sensation, as we have seen, is the state of consciousness of an impression. The essence of the notion of sensation is that of consciousness. An unconscious sensation would be the same as an unconscious consciousness. No form of psychic phenomena can exist without this consciousness, not even that seen in the spasmodic movements of a headless frog's leg. The unconsciousness is only apparent and is inferred from certain conditions, but in all such cases the truth of the independent individuality of lower nerve-centers, without which none of the phenomena ever take place, is ignored.

Sensation and feeling are really one and the same thing, but the former term is used to denote all forms of feeling in the abstract, and to disconnect entirely the idea from that of agreeableness or disagreeableness which so naturally associates itself with the latter. That there exist feelings which are entirely indifferent admits of no doubt, and the chief sensations which enable us to perceive the properties of bodies are of this nature. If an object is taken in the hand, and the process of "feeling of it" is gone through with in order to learn what it is, *i. e.*, what properties it possesses, no such sentiment as pleasure or pain is experienced, and yet the sensation produced by the object is plainly recognizable as a definite state. If the same object is placed on the back of the hand, or on other parts of the body, the sensation, though neither pleasurable nor painful, is still more distinct than when held in the fingers. But, if the attention is directed to the perception instead of to the sensation, it will be seen that a much clearer idea of the properties of the object is obtained when it is held in the fingers than when applied to the back of the hand. This illustrates the well-known law that the powers of perception and of sensation are inversely proportional.* The extreme instances of this are found in the action of the nerves of the eye and the ear. Here the sensation escapes us entirely, so that by the closest attention we

* Sir William Hamilton, "Metaphysics," lecture xxiv.

are wholly unable to recognize any form of feeling as produced by the acts of hearing or of vision, and yet the perception is in these cases very distinct, seeing being regarded as the most complete mode in which the nature of an object can be brought before the mind. On the other hand, tissues which whether from inflammation or otherwise are "tender," *i. e.*, in which painful impressions are easily produced, are poorly adapted for the determination of the qualities of the objects brought into contact with them; and the same is true of such tissues as yield pleasurable sensations on moderate contact of external objects. This long-understood law teaches the new truth that in the process of organization and the development of the tissues different kinds of nerve-tissue are produced, adapting it to different ends in the economy of the organism, and that, while at most points on the body the sensitiveness is not greater than is required to give proper warning of danger, and is capable of yielding the impression of pain in case the contacts become sufficiently violent to endanger the well-being of the creature, there are certain special points, more exposed from their location to moderate contacts, at which the differentiation has been in the direction of increasing the faculty of perception, or the clearness with which the qualities of the objects are made known. These nerve-tissues may be said to have become accustomed to pay attention only to this one side of the two-sided phenomenon, and in proportion as attention is so concentrated it is withdrawn from the other side. This affords another instance of the essential homogeneity of all nerve-tissues, including the brain. The power of the brain to become accustomed to give its whole attention to one thing, with a corresponding disregard for others, is a favorite theme for writers on the mind. Yet here are tiny nerves at the extremities exhibiting these wonderfully mind-like characteristics. That the whole distinction is, after all, a product of the brain, and due to different modes of sensorial co-ordination, no physiologist would maintain. The differentiation has taken place in the nerves at the extremities, which, when accurately dissected, exhibit corresponding differences of structure.

As regards the other class of sensations, or those which give rise to pain or pleasure, they are the original source of the emotions. An indifferent sensation can have no economic value except as a means of perfecting perception. The less obtrusive the sensation the greater the advantage. Such sensations are therefore as completely eliminated as possible from the supreme consciousness. That a sensation must be produced upon the retina in every act of vision follows as a necessity from the perception itself. The two are not independent, but are a common phenomenon. If precedence, in time, is to be given, it must be to sensation; but, as already shown, they bear no necessary relation to each other as regards the degree with which they are manifested, and, in point of fact, they appear within certain necessary limits to vary in an inverse proportion. The inability to recognize the sensation produced by the act of vision is due in part to the subtile character of the medium which alone produces the contact, and in part to the fact that the sensation actually required to yield the perception is not carried to the sensorium at all, and is confined to the retina and the optic lobes. This is nothing more than is true of thousands of very vivid sensations and those resulting in necessary pain, the sensorium being so completely engrossed in other matters as actually to refuse admission to the molecular vibrations conveying them.

But the opposite class of sensations have a special duty to perform, and their efficiency is kept up for this purpose. The normal operations of the organism must be maintained; life must be preserved; the species must be perpetuated. Natural selection has therefore made those acts which secure these ends pleasurable, and those that threaten to defeat them painful. Any species in which these sensations are not sufficiently lively to secure the performance of the acts necessary to maintain and perpetuate its life, and to defend it from external dangers, must rapidly become extinct, and only those species have survived in which the sensations were sufficiently developed for these purposes.

The seat of these sensations is not altogether peripheral. The functions of the internal organs are also regulated by them, and it is the internal pleasures and pains, far more than the external ones, which influence the affairs of human life. The collective effect of all the internal sensations of the positive (non-indifferent) class constitutes what are termed the *emotions*. The vagueness of this class of feelings has generally been taken to indicate their higher and less sensual character; but in truth they are equally dependent on the actual presence and contact of material objects. The want of food produces hunger, and of water thirst. The tissues actually require the supply of these materials, and suffer pain until they are introduced into them through the appointed channels. But when a mother mourns for her lost child the exact modifications of structure undergone in producing this emotion are far more obscure. And yet we can not doubt that the violent waves of anguish that course through her body, many of which she can easily locate, are produced by actual changes going on in the interior nerves, caused by the lack of an accustomed activity, which the presence of her child supplied. And this satisfaction, now suddenly withdrawn, is the result of that economic law which required the development of the maternal instinct as a necessary protection against the possible extinction of the race through the destruction of the young and helpless. One of the necessary conditions to the maintenance of the equilibrium of the nervous organization of that mother as derived from the inheritance of all the economic tendencies of her ancestors had been removed in the death of her child, and painful sensation was the result. And even in the case of two friends suddenly deprived of each other's society, where no parental or sexual instinct can be called in to explain it, there remains the social instinct, derivative though it be, yet in certain cases deeply graven upon the whole nervous constitution of man.

It can not of course be claimed that any thing like a mechanical theory of the *modus operandi* of the emotions can be given; but this much can be asserted with certainty, that in all such phenomena molecular changes take place in the tissues of the nervous system, which must be regarded as the immediate mechanical cause of the emotions themselves. Moreover, most of the emotions can be localized, and the particular system of nerves whose derangement occasions them can with considerable certainty be announced.

The brain has little to do with these bodily states, except as they are co-ordinated by the sensorium, and brought under the general consciousness. But the cerebrum is itself the seat of important emotions of its own wholly analogous to all the others described. The exalted states attendant upon the discovery of truth and the acquisition of knowledge belong to the class of purely cerebral emotions, and they are capable of affording the highest form of satisfaction.

The most important product of the economic laws of adaptation, which have been perpetually operating upon the human race all through its long course of development from the animal stage and creating those emotions which tend to preserve life and perpetuate the race, is what may with entire propriety be called the *social instinct.* For those who recognize the law of adaptation the fact that a given condition could not have been attained without a certain attribute is a sufficient *raison d'être* for that attribute. The social instinct is an attribute of the human race wherever it exists as a society. This sufficiently accounts for such an instinct. Among incipient societies the law of the survival of the fittest prevailed, and, as we can easily see, no society was fit to survive which possessed no social bond, whether due to a blind feeling of attachment among its members or, as was doubtless largely the case, to an intellectual conception of the advantages to be derived from co-operation. And, as Mr.

Spencer argues, and Mr. Fiske still more clearly points out, the earliest moral conceptions were exclusively utilitarian; direct advantage to self was the sole standard of action; but so unerringly did the general economic laws operate, that just these egoistic sentiments were what was necessary to preserve the race and its social communities. And those instincts which tended to preserve both the individual and the community were gradually associated more and more with the latter object, until at length the former was lost sight of to such an extent that most of the attempts to understand the laws of moral science have not only ignored the egoistic or utilitarian principle, but have denied it, and maintained that this science deals with an abstract moral sense. The great philosopher of Königsberg stumbled on this rock, and sought to found a science of "pure morals" co-ordinate with that of pure mathematics.* But these truths of ethics are coming to light along with the truths of anatomy, and it is now perceived that the utilitarian principle has been obscured by ages of hereditary modification, and only appears under certain peculiar conditions, very much as the anatomy of the human body has been gradually modified, until its relationship with the lower forms from which it sprung is only revealed by "rudimentary organs" and cases of "reversion." But I can not agree with Mr. Fiske that there is anything real in this principle of abstract morality. There may be many cases in which the egoistic influence can not be reached by any analysis we can make of the motives to action, but, upon the whole, and with the great mass of mankind, the law of "greatest gain" bears universal sway, controlling all the business transactions of life as regularly as the laws of physics. And the suspicion is irrepressible that, in every case in which apparently abstract moral principles seem to override this law, it is because we are not qualified to understand the motives or the mental constitution of the persons whose conduct we are observing. Altruism itself is based on ego-

* "Kritik der reinen Vernunft," Leipzig, 1868, S. 340.

ism, and it is according to those economic laws of nature to which we have referred that it should be so. To say that the utilitarian principle of action is low and unworthy of mankind is to reproach nature, which has made that principle universal throughout the domain of organic life, and the great means by which individuals, species, nay, and societies too, are enabled to maintain and continue their existence. The effect of denying this truth is to erect a standard which is too high to be realized; to attempt to realize such a standard is to demoralize society. All claims to this effect are only pretensions, and between the hypocrisy of the self-styled paragons of morality and the despair of the honest masses the worst forms of selfishness are certain to be developed. It should therefore be constantly insisted upon by the advanced school of philosophers and scientists that one of the chief merits of the recent theory of man's development is its moral effect in lowering an artificial standard, which the laws of social science, of political economy, and of business ignore or contradict, and whose maintenance as a code of ethics is destructive of all true morality.

The fulfillment of organic function is always pleasurable, but the pleasure is usually moderate. Only in the two most important functions, those of alimentation and propagation, does the pleasure become extreme, and in these cases the supreme necessity for their performance is an ample reason for their intensity. The emotions arise from failure in some way to fulfill the normal functions. They are therefore essentially painful in their nature, but this term frequently fails to describe the state produced. They may be divided into two classes: 1, those occasioned by the deprivation of functional activity previously enjoyed; and, 2, those occasioned by the prospect or anticipation of such an exercise in the future. The former are *emotions proper*, the latter are *desires*. There is, however, no radical distinction between these states, and a gratification lost creates a desire to regain it, while both are equally emotions. The former class are the more painful as the change is more sudden; the latter when they take the form of hope, and when the representative powers are vivid, often constitute a sort of pleasure which to some natures seems to be even sweeter than the actual gratification anticipated (vol. i, p. 676; ii, pp. 150, 284). There is, too, the sentiment which has been called the "luxury of grief." But these are highly artificial forms, due to the great development of the imagination, which need only to be referred to in passing. Among the lower animals all these states are undoubtedly painful.

Actual gratification is itself sometimes called an emotion, as when one reaches the top of a mountain and first looks down upon a picturesque valley. But even these vague but intense feelings are probably the result of a series of rapid representations of imaginary gratifications assumed to be in store for those that should occupy the paradise which distance and position have created. It is the vague sense of possible happiness connected with beauty. Animals experience little or nothing of these thrills, neither do the lower types of mankind. They are sentiments which have grown up with the growth of the higher faculties and been developed to a great extent artificially by the pursuit of the fine arts.*

The one thing common to all proper emotions is the sentiment of *desire.* The gratification of desire is the satisfaction of the demands of the nervous system, and this is only accomplished by the complete and natural exercise of the

* That development of the æsthetic faculty which has resulted in the keen appreciation and admiration of the picturesque, is a comparatively recent process. The total disregard for the finest natural scenery of Europe which must have been frequently seen by the most cultivated men of the Augustan age has been remarked by Humboldt and other writers ("Kosmos," vol. ii, S. 16). Landscape-painting was unknown to the ancients, and landscape-gardening is a very modern art (see Carpenter's "Mental Physiology," pp. 513, 514). That this was natural in the then condition of the human mind is sufficiently obvious from numerous utterances that were made by the cultivated men of ancient and mediæval times (see Hugh Miller's "Testimony of the Rocks," p. 411).

functional activities of that system and of the organism in general. To secure such satisfaction and gratify desire, certain appropriate mechanical actions are performed by the individual experiencing these mental states, which are altogether determined by the circumstances of each case.

Frequently more than one desire may exist at once, and in such cases it may happen that the action which would gratify one would render the gratification of the other impossible. With animals such cases rarely receive sufficient consideration to exert any influence upon the action performed. The strongest impulse is obeyed, and the consequences are ignored. But with man, as soon as he began to form societies, such conflicts of desires became frequent. The social instinct must have had to battle long and hard against the momentary selfish desires of individuals, and its triumph was due to the fact that the desire of each to protect himself by sustaining the community gradually came to exceed the desire to gratify immediate personal wants which were incompatible with the existence of society. And this is exactly what the "social compact" amounts to, of which so much has been said. The maintenance of the social state, which was at its origin, and still is, opposed to the gratification of many strong personal desires (vol. ii, p. 232), depends upon the degree to which its benefits are realized, whereby the counter-desire of a higher order antagonizes the antisocial tendencies and finally subordinates them. But society must have begun with a very small circle or with many such circles, each starting with single families so as to receive the aid of a certain growing amount of natural parental, filial, and fraternal affection. Family pride, too, so powerfully manifested in certain "clans," must have been a factor of some value in nearly all cases. These influences coupled with the advantages, which an ape ought to perceive as clearly as a wolf, gradually gained for the social tendency an ascendant which secured its ultimate triumph. These considerations belong to the two following chapters, as well as the very important one of the influence of government in conserving society, and have only been touched upon in this place to illustrate the legitimate influence of the emotions.

Just as the social instinct, and therefore society itself, has been the result of a conflict of desires, so can it also be shown that all that we denominate proper conduct, and the very sentiment of right and wrong, have risen and assumed definite shape in precisely the same manner. Indeed, the social instinct and the moral instinct are so closely allied, or rather, are to so great an extent identical, that it scarcely seems necessary to follow out the genesis of each separately, and the only object in introducing the latter at this time is to endeavor to convey a clear conception of what is involved in the term *will*, which is claimed to lie at the foundation of moral science, and is also set down among the normal attributes of mind. The consideration of the nature of this attribute, therefore, naturally belongs here.

We have seen that the social instinct and the moral instinct are the products of the development of social and moral desires, having at the outset at least a strictly utilitarian or egoistic motive, and the gradual elevation of such desires to the point at which they prevailed over what we may, by way of antithesis, call the animal instincts; though by no means are all animal instincts anti-social or anti-moral, and the social and moral instincts are as strictly animal as any other.

Social and moral desires are founded upon three primary elements: 1, *affection*, arising out of family instincts, parental, filial, and fraternal; 2, *reason*, the rational belief that it is more advantageous to co-operate and forbear than to pursue the opposite course; and, 3, *sympathy*, the painful sensation which results to high nervous organizations at the sight of suffering in others.

These three bases of emotions, it will be perceived, stand in an ascending series in the scale of progressive development of mental attributes, and yet each is clearly egoistic. Affection, or the family instinct, is an attribute of all animals at all developed, and it therefore operated with full force at the origin of society. The rational motive was later developed, and marks an era of great progress. It must have been preceded by a considerable cerebral enlargement, though not necessarily enough to be classed as essentially human. Sympathy was of much later origin, and could not have arisen until vivid mental representations could be made of the state of suffering in others based on the experience of each individual of like sufferings in himself. This is the psychological analysis of the so-called "golden rule" of the moral teachers of antiquity, Confucius, Hillel, and Jesus (*supra*, p. 10). It can not be realized until the organ of reason and intellect has been sufficiently developed to enable the person witnessing pain in another to conclude, first, from the similarity of the form and character of the other individual to his own form and character, that causes which have produced, or would produce, pain in himself must produce pain in the other individual so like himself; and, secondly, to realize or recall in a vivid manner, from the belief that the other object is suffering, the feelings formerly experienced by himself under similar circumstances. Not only are the organizations of animals not capable of such refined operations to any great extent, but neither are those of the lower races of men or even of the more degraded of the populations of the civilized world.

The three classes of motives above enumerated constitute what are called the higher sentiments or impulses, and are contrasted with the lower impulses chiefly actuating animals, the carnal appetites, etc. These latter, it must be borne in mind, have been developed by natural selection to secure the fulfillment of the primary organic functions, and they exist still in the highest types for this purpose. Of the two classes, therefore, these must be regarded as by far the more important, if we look upon the preservation of existence as a thing to be desired. But with the animal ancestors of man these motives alone had indeed preserved their existence and enabled nature to work a great advancement in physical and mental organization, though in so doing they had been restricted to a circumscribed habitat, and had been unable to multiply beyond a certain limited number, all excess over that number succumbing to adverse conditions, as in the case of the other animals that make up the faunas of the various regions of the globe. The effect of the supremacy of the higher sentiments above enumerated and described would naturally be to change all this. Where, in the comparatively solitary life before led, they would one after another come to a premature death by the violence of the great *carnivora*, or by lack of food, or in some other way, the co-operative habit produced by the social instinct would enable them to attain a greater age and leave a more numerous progeny. And where obedience to fierce passion before made them to a large extent the destroyers of one another, the moral instincts, if heeded, would accomplish their mutual protection. In the transition state between the periods of supremacy of these two classes of motives, a constant struggle was kept up for the mastery, and in civilized life a strong current of that same turbid torrent still sweeps through society. Now, as then, is a battle at all times being fought between the lower and the higher impulses of man's nature.

The mental phenomenon which is called *will* is always manifested when two antagonistic motives are struggling for the mastery in the same individual at the same time, *i. e.*, when of two actions only one can be performed, and there exists a desire to perform them both. In most cases the exercise of the will is on the side of the higher as against the lower impulse or desire. But this is not necessarily the case; neither is it necessary that the two desires should belong to opposite classes. There is really nothing in the will except the simple fact that one of the desires prevails over the other, and the action is performed at the behest of the prevailing impulse or desire. Yet from the peculiar constitution of the mind there is an apparent *nexus* or *tertium quid*, which is called an "act of volition," and which *seems* to come forward as the true cause of the mental decision rendered; but science and philosophy have so long searched for this mysterious factor without finding it that its existence is now denied by all except those who are prepared to credit the human mind with the power of originating that which has no other antecedent, and who consequently can conceive of an effect without a cause. This school of philosophers can really have nothing to do with true science, and science can have no real meaning for them.

The phenomena of mind are subtile and perplexing at best, and belong to the highest and most complex of all the classes of truth with which science has to deal. It was shown in the Introduction (pp. 47, 50) that even the simpler truths of physics, chemistry, etc., have been found to present difficulties, puzzles, and paradoxes, at every step in their investigation. It is, therefore, not surprising that the far more subtile phenomena of mind should present enigmas and paradoxes even more remarkable, and thus baffle the common intellect and that of the philosopher as well. That the phantom of the will is such a paradox there is no doubt. Already far more deeply cherished beliefs in various departments have been remanded by science to the limbo of paradoxical myths, and I see no reason for clinging with such pertinacity to the will after it is shown to be only a *will-o'-the-wisp*. Human actions will not be affected by the possession of one term more or less in the nomenclature of psychology, and in all sciences the reduction of the number of elements, where this can be done without compromising the phenomena themselves, is always a gain. Simplification is the great *desideratum*, and, where this can be done, it is better to lop off a clearly redundant branch than to accomplish this object by a higher generalization.

Briefly to sum up the conclusions to which we are led by our review of that branch of psychic phenomena which starts with sensation—and which may therefore be called the subjective department of mind—we note first the primary subdivision of sensations into indifferent, or negative, and those positive sensations which assume the character of pleasure and pain. We saw that the sole object of the first was to afford a basis for the determination of the qualities of the objects producing them, and that, from the habit of withdrawing the attention from the sensation and concentrating it upon the qualities producing it, the increase of this latter power carried with it a proportional diminution of the degree with which these sensations are carried to the sensorium, so that the two appear to exist in an inverse proportion.

Positive sensations, on the other hand, were seen to have an important office to fill, and it was shown that upon them depends the very performance of all the higher vital functions. They must, in fact, have arisen through the law of natural selection, as the only incentives to the preservation or continuation of life. This solves the whole problem of the origin of pleasure and pain. Pleasure leads to the performance of those acts which are essential to the preservation of life and to the continuation of the species. Pain leads to the performance of those acts which avert danger and prevent the destruction of life. Sensations are further subdivided into those which are external or peripheral and those which are internal or visceral. The former class, besides furnishing nearly all the objective sensations, furnish those subjective ones which are caused by the most direct influence of the environment. They thus chiefly determine the *shape* of the organism. The internal or visceral sensations, besides contributing principally to the determination of the *structure* of the organism, by adapting it to the character of the food, air, etc., by which the tissues are supplied, also constitute the basis of that class of feelings known as the emotions. The emotions are the condition of instincts and the result of desires. They generally have each its definite local seat in the body, and depend upon molecular changes taking place in certain systems of nerves. They are of two kinds, according to whether an habitual function has been suddenly terminated or a pleasurable experience is withheld. In either case they are in the nature of desires. They are of various kinds, both original and derivative. The most important groups of primary emotions are those connected with alimentation and reproduction, upon which the whole organic economy absolutely depends. From these arise numerous accessory and derivative emotions which will be enumerated in a future chapter (*infra*, p. 666). The most important derivative emotions are those having their local seat in the cerebrum. These will be better understood after we have followed out the objective branch of psychic phenomena, but we may say here that desires, however generated, become emotions when prolonged with the requisite intensity.

The exercise of reason gives rise to desires which, though of a high order and less violent than those of passion, frequently take the form of true emotions and largely influence conduct. The progress of the development of the brain has been attended with a constantly increasing proportion of these rational emotions, and these have necessarily found themselves, in a large measure, in conflict with the non-rational emotions. The social state rests on the moral state, and, with man, both are incompatible with the unchecked play of the non-cerebral impulses. Society itself depends upon the greater or less ascendency of the rational, and subordination of the sensual, emotions. However much ideas may serve to guide mankind, they have no power to propel. It is only when they are crystallized into desires and emotions rising out of beliefs that intellectual activities become indirectly forces of civilization. The conative faculties of mind embrace all those which relate to the struggle between the rational and the sensual emotions. This struggle had well begun when the historical period was ushered in. Man, therefore, knows no time when there were no moral questions to perplex him. Yet certain savages distinctly remind us of such a time in the career of our race. But perpetual familiarity with such questions has naturally led to the introduction of anthropomorphic solutions, as in the case of all other questions of pre-scientific times. The doctrine of the will as a distinct faculty of the mind independent of and distinct from all others, and capable of originating action without itself having been originated, is one of those anthropomorphisms which the deceptive order of things naturally brought forward as the easiest explanation of all the facts. Its place is among the historical archives of philosophy by the side of the *Archæus* of the biologists and the *Spiritus* of the chemists. Like these and the whole train of daimons and gods that preceded them, it is not only not needed, but is decidedly in the way, so soon as the natural or causal explanation is brought forward.

It remains to follow out in something more of detail the objective branch of the psychic phenomena which give rise to the intellectual states.

As we have already seen, in addition to the sensation itself, or primary consciousness of the presence of the object, there is, when the contact is not too violent, a secondary consciousness of the *manner* in which the object appeals to the nerves. This secondary consciousness determines the properties of the object in so far as they are revealed by the contact, and is called perception. The immediate relation in which every organism stands to the multitude of objects constituting its environment necessitates the production of an incessant train of perceptions of every conceivable kind, and thus informs the creature of the nature or properties of all these varied objects. These perceptions are registered with greater or less permanence in the plastic tissue of the nerves and ganglionic centers, and particularly in the supreme center, or brain. Whenever, therefore, an impression is received which has been previously made, the identity is recognized, and the impression strengthened. The properties of bodies thus become more thoroughly known in proportion to the number of times their perception is repeated. Perceptions also differ in distinctness according as they are more or less forcibly produced and more or less isolated, so as to allow the mind to attend to them separately. In this manner the organism gradually becomes acquainted with its environment and learns to conform its actions to it. It is evident that, as the organs of special sense increase in number and power, the environment correspondingly widens and increases in complexity and multiplicity. The number and quality of the perceptions expand and the range of data furnished to the mind by the environment enlarges. The frequency of identical perceptions is diminished and that of distinct ones increased. The number of categories to which the mind must refer them is thus multiplied, and it is clear that this would wholly bewilder the strongest intellect if no means of simplification existed. But, while innumerable perceptions produce innumerable impressions sufficiently distinct not to be identical, these are nevertheless not so distinct but that thousands of them are *similar* to other thousands, and thus the mind is called upon to perform a new duty quite distinct from the mere registration of impressions. This is to compare and classify them. In addition to dealing with the direct changes produced in the nerve-tissue by the various impacts made from without, it has now to deal with the *relations* which subsist among the impressions thus registered. It has to arrange them into groups having characters in common, but still not identical throughout. It must now determine to what extent there is identity and to what extent variation. This is an interior and properly intellectual process, which, though begun in a very early stage of organic development, is only extensively carried on by those beings which have a highly organized nervous system with a predominant ganglion and complete subordinate system of ganglia and nerves.

The act by which a new impression is compared with old ones and declared to have a certain resemblance to them, or to belong to an already established group of such similar impressions, may be called a *conception*, and constitutes the first strictly relational psychic phenomenon. We thus have the following series of effects: 1. The object is brought into contact with the subject, and by its properties makes the latter conscious of its presence by means of a *sensation*. 2. Through this sensation the nature of the properties of the object are cognized or made known to the subject in what we call a *perception*. 3. The physiological equivalent of a perception is a molecular change in the nerve-substance of the subject which is called an *impression*. 4. The psychic action by which impressions, similar but not identical, are recognized as such, and thus logically grouped, is called *conception*.

All the higher intellectual operations are but the extension of the process involved in conception to psychological units of higher orders. This primary act deals directly with the first of relations, that of likeness, or, what amounts to the same thing viewed from the opposite side, that of difference. With this relation, or some derivative of it, all intellectual operations must necessarily deal. The conceptions first formed become the psychological units of a process of classification of an order one stage higher, and these again become new psychological units for generalizations of still higher degrees. The products of these several acts of the mind are variously denominated ideas, judgments, rational conclusions, etc. In the entire series we find a perfect homogeneity and uniformity in the process, and are vividly reminded of the universal law of aggregation, which we have sought to trace from the ultimate atom to the organic unit, and which we shall follow out to its culmination in the social aggregate.

Memory, as has already doubtless been inferred, is nothing but the fact that impressions once registered possess a greater or less degree of permanence. And this is true of all mental states. An impression is a mental state. It resides in the subject, and is locally separated from the object which produced it. But every molecular change is no less a mental state, and leaves its appropriate impression; so that not only are perceptions registered and capable of being called up by the proper stimulus, but so are also conceptions, ideas, and thoughts of whatever kind. This is memory.

Consciousness, as we have already seen, is not only all that Sir William Hamilton claimed for it, but it is more. It underlies sensation itself. To be sentient is to be conscious.

Reason, as a faculty (*Vernunft*), is the intellectual *power* which exerts itself, as already described, in the co-ordination of perceptions, conceptions, ideas, and all the psychological units. *Reasoning* is the intellectual *process*, and may be either simple, direct, and intuitive, when it sometimes takes the name of *judgment*, or compound and indirect, when it is called *ratiocination*. The charge of *petitio principii* which has been, not groundlessly, made against this last process, lies equally against every other intellectual process except that of original perception; for beyond this nothing is original, and all the higher psychic operations have for their sole object to determine all the implications in experience, and to exhaust the possible relations subsisting among received impressions. Impressions frequently belong to the same class, although their direct comparison does not reveal this fact, and it does not appear until they have been separately referred to the same class; and this is the essential characteristic of syllogistic reasoning. It is, however, true that, in practice, the full syllogism is rarely used to determine the relations of ideas; but its chief and important service is in the *verification* of suspected relationships among ideas. The syllogism is a *test of truth* rather than a means of reaching it.

The intellect is thus seen to be a unit and not a congeries of independent faculties. The term "faculty" may prove convenient in aiding us to mark off the various manifestations of the one connected process, but warning should be taken from the past history of intellectual philosophy not to assign to any faculty too great a degree of independence in the scheme of psychic phenomena.

Quantitatively considered, intellect has been aptly styled the "co-efficient of intelligence." The degree of intellectual power is the measure of capacity for acquiring knowledge; and intellect, with acquired knowledge, constitutes intelligence. This intellectual power is of two sorts, which are very correctly distinguished in popular language by the expressions *perceptive* and *reflective* faculties. All knowledge comes through the senses, and the keenness of the senses in correctly registering perceptions is the original measure of the materials of the intellect. But, as we have seen, registered perceptions, regarded as independent, serve only to confuse and bewilder the mind. Hence the paramount importance of that high cerebral capacity for co-ordinating, classifying, and generalizing these impressions, by which process the perceptions are, as it were, permutated, and all their most involved relations are brought out.

Intelligence must be carefully distinguished from intellect. The latter expresses the degree of psychic force of the objective class. It represents the mere mental capacity. Intelligence, on the other hand, embraces all that is implied by the term intellect, together with all its registered experience. There is some such a difference between the two notions as there is between a blank book and one full of printed pages. In a word, intelligence equals intellect plus knowledge. It must not, however, be inferred that, where intellect is equal, intelligence will necessarily be equal also. It is true that there can be no such thing as a perfectly blank intellect, or intellect entirely without knowledge. No circumstances in life can be conceived in which there is not a constant accumulation of experiences which, where the intellect is vigorous, will be duly registered, and produce a corresponding degree of intelligence. But the important fact to be noted is the immense difference in the value of different kinds of experience. In the first place, the nature of things is such, as has been previously pointed out (*supra*, p. 46, note), that while objects are correctly perceived and their properties are accurately noted so far as they manifest themselves, yet a very large part of the comparisons made and conceptions and ideas formed from the data thus at hand is false, so that the mind is filled with error instead of truth. And the higher the order of intellectual operation performed, the greater the liability to error. It is needless to add that actions growing out of these erroneous opinions tend to arrest all social and moral progress. Most error is due to the incompleteness of the data of experience, by which only one side of a many-sided fact exists in the mind; the rest, which may form the more important part, being disregarded, because never brought within the range of experience. Erroneous ideas can not be said to contribute anything to intelligence. But, aside from the great prevalence of erroneous impressions in the mind of early man and of existing savages, the quality of the actual knowledge possessed is such as to contribute comparatively little to their intelligence. It consists of such impressions as are made upon them by the limited range of objects with which they come in contact, and the ideas and opinions which they are able to derive from these by the normal intellectual processes. A very little is handed down in a distorted and exaggerated form by tradition. Limited intercourse with near surrounding tribes may slightly widen their own narrow circle of experience. Death destroys all that any one individual may have acquired, and each one must learn it all in the brief span of a life-time. Now, if we could imagine such a race endowed with as vigorous intellects as are the most enlightened nations, the degree of intelligence must still be exceedingly low. There is no fixed proportion between intellect and intelligence. The latter depends altogether upon the correctness of the ideas, the amount and value of the information, and in general upon the quantity and quality of knowledge possessed. But it is as easy to learn a truth as an error, a valuable as a valueless truth. The mind will be busy with the materials it happens to possess, and the results will be trivial and worthless or important and useful, according as these materials are poor or rich. While, therefore, the progress of intellect is a physiological fact, and belongs to the department of biology, that of intelligence is to a great extent the result of favoring circumstances, and must be referred to the department of sociology. Two races with the same intellectual capacity may differ to almost any extent in the degree of intelligence, and the same race at different periods of its existence, without undergoing any perceptible change in native mental powers, may represent two distinct planes of intelligence, and consequently of civilization. Such has, in fact, been the history of the Indo-European race, and it is still disputed whether the degree of intellectual power has at all advanced since the age of Aristotle, or of the far more ancient Brahmans. The reason why the intelligence of Europe and America to-day is so much greater than that of Greece and Rome two thousand years ago is not to any great extent because the power of intellect, or co-efficient of intelligence, has increased, but because the acquired knowledge is so much greater both in quantity and quality. And this, when sifted to the bottom, may be attributed to the more universal practice of recording, preserving, and inculcating on succeeding generations the truths learned by preceding ones and found by experience to be most valuable. Science itself is capable of being reduced to this formula. The general deduction which follows of itself from these facts obviously is that, where intellect is equal, intelligence will vary with the amount of *education.* This theorem will be fully discussed in the second volume of this work, and its important and far-reaching consequences pointed out (pp. 471, 475). The corollary from this proposition, that whatever most rapidly increases intelligence will also most rapidly develop intellect (vol. ii, pp. 484, 549, 564), will be readily drawn by all who have learned that in physiology an organ is always strengthened by use, and that acquired modifications are inherited. Thus does science at every turn point to education as the great lever of human advancement.

This rapid survey of the psychic phenomena should not be closed without a general remark respecting the true nature of mind itself. The question of questions has always been, Is the mind material or immaterial? So long as it was regarded by metaphysicians as an entity, both these alternatives were legitimate. In fact, where both parties are agreed upon this point, it must be confessed that the materialists had the advantage. For they could justly say, If mind is a thing, it must be made of matter. But science cuts off the debate on this line of argument, on whichever side of the question, for it declares that, of the only two possible categories, matter and relation, the phenomena ascribed to mind clearly belong to the latter. But these categories, unlike those of the old philosophies, are not independent. Relations subsist between material things, and in no other way. In and of themselves they are nothing.

Psychic phenomena are the relations which subsist among the material molecules of the brain and nervous system and between these and the material objects of the outside world which appeal to them by means of actual mechanical contact. All that we know of mind, except by our own consciousness of what is going on within ourselves, is inferred from the mechanical effects which it produces. We may stand close by the side of the greatest genius of the age at the moment when his mind is developing the greatest truth that has ever been brought to light, and be wholly unconscious of the mighty work. But, if he speaks, and unfolds to our auditory faculties through the medium of articulate language the thoughts that occupy his brain, we are, by this purely mechanical effect, impressed upon us through a series of tangible, material appliances, put in possession of the truth which, through a less obvious mechanism, has been evolved within him. Or the same result may be brought about by the still more obviously mechanical process of writing and reading. These silent and imperceptible relations are the result of interior processes, and are made manifest by exterior actions. Mind is immaterial because relational, but like all relations it has matter for its basis—the organized matter of the living body, actuated by the co-ordinated mechanism of a brain and nervous system. But, as we saw, relations constitute the properties of matter, and hence mind, as well as life, is such a property.

CHAPTER VI.

SECONDARY AGGREGATION.—(Continued.)

ANTHROPOGENY—GENESIS OF MAN.

Preliminary remarks—Homogeneity among organized beings—Man's place in the animal series—Lowest types of mankind—Anatomical characters indicating the simian ancestry of man—Argument from microcephaly—Argument from embryology—Popular objections to the doctrine of development—Argument from archæology—Causes and conditions of man's pre-social development—How increased brain-mass was acquired—How the erect posture was acquired—How articulate speech was acquired—General considerations on the origin of man—Unity of the human race—Local origin of man—Antiquity of man.

We are wholly ignorant to what degree the law of organic aggregation may have advanced in other portions of the universe than our own planet; we are not even certain that cosmical phenomena have followed the same path elsewhere as here and accomplished the creation of the vital substance, protoplasm; though, for aught we know, a still more wonderful product may have been somewhere evolved whose further aggregation may wholly eclipse the highest organic achievements with which we are acquainted.* Such speculations must, for the present at least, be dismissed, and we must content ourselves to contemplate the organized beings found on the earth.

* The recent alleged discovery of organic remains in certain meteoric rocks is as yet quite too problematical to furnish a valid ground for speculation as to life in other worlds.

Looking around us, we may well be amazed at the amount of organization to be seen on every hand, as well as at the wonderful degree to which it so frequently attains. Employing the popular terms, we behold in the vegetable and in the animal world a truly astonishing picture. The attempt to conceive of all this as the product of a vast *monistic* process which has been going on for ages in nature appalls the intellect, and we no longer wonder that a different explanation, in accord with the modes of human achievement, has been offered and generally accepted by the unscientific. But so many of these teleological and anthropomorphic explanations have already been compelled to give way before the march of science in its irresistible pursuit of true causes that it has ceased to be thought the part of true wisdom to defend, as exceptions to the law already admitted to be general, any, even the most cherished, theories of a supernatural creation. Rising thinkers, who would gladly conserve much of the belief of the past, are now hesitating in the midst of the swift current of progressive thought, lest a few more years may leave them the unwelcome alternative of defending theories which science has completely overthrown or of receding, with whatever grace may be left them, from positions which they have wasted a life-time to sustain. The risk is certainly small as between the natural and the supernatural explanation of a fact in espousing the former even in advance of that positive proof which science alone seems to be required to furnish. Consistency has been called a jewel, but never is it more precious than in philosophy. The philosopher who accepts so much only of a great principle as seems to accord with his practical interests or his education is not respected even by those who for the same reasons desire to agree with him. On the other hand, the brave mind which withdraws its personality and lets the unfettered sword of logic cleave through the warp of tradition, education, public opinion, and self-interest, is always honored, even by those whose fondly cherished errors have been thereby assailed and destroyed. That species of "dualism" which assigns to certain phenomena, whose causes are simple and easily understood, a natural or genetic explanation, while for those which are more complex, and as yet beyond the reach of true scientific methods, it claims a teleological or supernatural explanation, should no longer be regarded as a form of wise conservatism, useful in preventing extremes of human opinion, but as an example of intellectual deficiency, by which the grasp of truth is enfeebled by the fear of consequences and the voice of reason muffled by conventionalism. The fact alone that the progress of thought, as directed by that of science and increased knowledge, has always been in the one direction of substituting the natural for the supernatural, in proportion as it has been brought within the reach of scientific investigation, and never in the reverse direction, should be sufficient to deter any devotee of science from upholding the non-scientific dogmas which precede exact knowledge. While the complete suspension of the judgment on questions not yet fairly within the reach of scientific methods is certainly a most healthy state of mind, the defense of a truly scientific hypothesis as against a wholly unscientific one is often a greater service to science and to truth than an actual investigation of facts.

Among all the forms of organic life there is not one which differs so widely from the rest as to raise a suspicion of having originated in a different way. The broadest distinction that can be named is that which separates the manufacturing from the non-manufacturing organism, the *autogen* from the *parasite* (*supra*, p. 350). But even these qualities are sometimes united in the same individual, and the closest scrutiny fails to find a definite boundary-line between them.

Organization in its widest sense is a means by which protoplasm can produce effects upon larger masses of matter and upon matter of a different kind from itself. The plant and the animal, widely as they seem to differ, agree in both being embodiments of this truth. The different forms of plant-life all bear marks of resemblance close enough for science to fix their relationships, and even to trace to some extent their line of probable descent. Animals, though presenting a higher kind of organization, being no longer required to perform the drudgery of production, still have strong relationships from the lowest to the highest. The widest distinctions found among them are those which separate the so-called "types" of structure. And yet the assertion of a different origin for any of these types is now vigorously repelled by biologists of all schools. Still closer is the bond between the different classes within each type. The relationship of the amphibians and reptiles to the fishes, and of the birds to the reptiles, is now universally acknowledged. A close affinity is also pointed out between the lowest mammals (the Monotremes) and both birds and reptiles, while the mammalian class consists of several diverging series of closely connected steps, from the *Ornithorhynchus* to the horse, the dog, the elephant, and the chimpanzee. Whosoever should attempt to break this chain of relationship and maintain a different nature or mode of origin for any of these forms, would be speedily read out of the synagogue of science as a charlatan and an impostor. However widely men may differ as to the origin of animal life and of species, the fact of their relationships and homogeneity can not be gainsaid, and whatever has been the history of one has been that of all.

Now, we find within the mammalian class, I will not say at the head of it, a genus, or, as some claim, a species, systematically named *Homo*, which, had it simply been found fossil, would have been immediately referred to its proper place in the series, with scarcely a remark, except as to the unusual capacity of the cranium. This genus belongs to the type or department of the *Vertebrata*, to the class *Mammalia*, and to the sub-class *Placentalia*. It further belongs to the division of that sub-class which has the deciduous placenta, and to the still more restricted group in which the placenta is attached by means of a disk. In other words, this genus agrees with millions of organisms in possessing a vertebral column, with hundreds of thousands in suckling its young, with tens of thousands in nourishing the fœtus by means of a placenta, with thousands in having that placenta deciduous, and with thousands more in the manner in which it is attached to the inner walls of the uterus; these several characters being the most reliable ones which naturalists have been able to fix upon to determine the relationships of animals. And not in these only, but in all the correlative characters which, with something less of regularity, go hand in hand with these, is man found to hold his place right *manfully* in the animal kingdom. Yet this is the being which it has been sought to separate from that kingdom, and establish by itself in another "corner" of the universe! If a man differed as widely from an anthropoid ape as a seal differs from an *Octopus*, or a humming-bird from a sphinx-moth, there might be more ground for assigning to him a separate place in creation. If he even belonged to a different class, or sub-class, or division of the sub-class, or group of this division, there might be a faint excuse for such a course. But such is not the case, and according to all the accepted principles of classification the man and the ape belong to the same order or family of animals. When as great an anatomist as Professor Huxley declares that "the structural differences which separate man from the gorilla and the chimpanzee, are not so great as those which separate the gorilla from the lower apes," * and when Haeckel emphasizes the remark that "in his entire organization and his origin man is a genuine catarrhine ape," and assigns to him "his natural position within one of the divisions of the order of the apes," how shall we reconcile these assertions with that of M. A. de Quatrefages that "we are not animals"? † The

* "Man's Place in Nature," p. 124.

† See "Popular Science Monthly," vol. v, p. 527.

last-named writer is a professed anthropologist, and is not ignorant of the anatomical facts here stated. He professes to rise above anatomy and to see in the human intellect a distinction sufficiently wide to warrant such a classification. But such a procedure can not be recognized by science. The character relied upon is not only not one which the laws of classification will sanction as sufficient, but when properly studied it proves to be quantitative only, and even bears those marks of continuity, and exhibits those intermediate transition-stages, which clearly show the connections which bind man to the rest of the animal world. That physically, at least, man is an animal, no one can deny who possesses any adequate conception of what constitutes an animal, and this much M. de Quatrefages frankly admits. His body is made up of the same kind of tissues as those of all other highly organized animals—the same skeleton, muscles, nervous system, digestive apparatus, blood-vessels, secretive and excretive organs; the same number of limbs and digits, of eyes and ears, constructed with the same mechanism; the whole co-ordinated and operated in the same way, performing the same functions, if any of which are suspended the same evil results ensue. Moreover, the sensibilities of man are manifest in other animals, and Descartes's doctrine that they are mere automatons is not only an insult to the simplest common sense, but the ridicule of both philosophy and science. We also see unmistakable evidence of the existence throughout the entire animal kingdom of a degree of self-guiding power which is strictly identical with the common conception of mind, to a certain extent proportioned to the mode of existence and the wants of the creature.

These facts alone would be amply sufficient to assimilate man completely to the animal life of the globe. But these are only the most general relations. In addition to them we find that the particular type or plan on which the human body is built is identical with that on which all the most highly organized animals are constructed. As we have already briefly set forth, the human skeleton is made in complete conformity with the vertebrate type, the reproductive system is strictly mammalian, and belongs furthermore to the more restricted groups in which the placenta is both deciduous and discoidal. This latter character is shared only by a small group of animals composed of the rodents, the *Insectivora*, and the bats, in addition to the group of lemurs and the apes. Within this narrow sphere man is immovably fixed by these anatomical characteristics, which he can no more alter than a leopard can change his spots.

Of all the families belonging to this group, man undoubtedly most resembles that of the apes. Aside from that general appearance familiar to every one, but not formerly believed to possess any scientific significance, the anatomical study of the apes has revealed the most astonishing coincidence among the leading characters and those of the human body. This is especially true of the Old World monkeys, or catarrhine apes, in which the dentition is identical with that of man. Among these there are species in which the head and face are remarkably conformed to the human type, the nose being reduced in *Semnopithecus nasicus* to proper human proportions, and the face being nearly destitute of hair except a surrounding circle of whiskers. In the true anthropoid apes the resemblance to man is still greater. The tail here disappears as completely as in man,* a semi-erect posture is attained, and a stature not greatly differing from that of the average human being is acquired. If before the appearance of man on the earth an imaginary painter had visited it, and drawn a portrait embodying the thorax of the gibbon, the hands and feet of the gorilla, the form of skull of the chimpanzee, the brain-development of the orang, and the countenance of *Semnopithecus*, giving to the whole the

* The coccyx of the gibbon contains one less vertebra than that of man (Haeckel, "Anthropogenie," p. 575), and this is also true of the Barbary ape *Inuus* (Mivart, "Lessons in Elementary Anatomy," p. 58), which, however, is not an anthropoid.

average stature of all of these apes, the result would have been a being not far removed from our conception of the primitive man, and not widely different from the actual condition of certain low tribes of savages. The brain-development would perhaps be too low for the average of any existing tribe, and would correspond better with that of certain microcephalous idiots and cretins, of which the human race furnishes many examples.

But not only do the highest apes thus approach the human race; the human race, when all its varieties are understood, also approaches the apes in a scarcely less striking manner. In the interior of the Island of Borneo, according to reliable authority, there is a race which is not distinguished from the apes by the more advanced coast-dwellers of the island. They live, says Mr. Dalton, "absolutely in a state of nature, who neither cultivate the ground nor live in huts, who neither eat rice nor salt, and who do not associate with each other, but rove about some [the] woods like wild beasts; the sexes meet in the jungle, or the man carries away a woman from some *campong*. When the children are old enough to shift for themselves they usually separate, neither one afterward thinking of the other. The poor creatures are looked on and treated by the other Dyaks as wild beasts." *

The Veddas of Ceylon are scarcely superior. They live in the vast forests without any habitation, and possess no flint or stone implements. They can not count or discriminate colors, and are said never to laugh. In the jungles of India there lives a race of low stature, round head, coarse black woolly hair, dark-brown skin, low, retreating forehead, the lower part of the face projecting like that of a monkey, thick lips, protruding an inch beyond the nose, a long body for the size, with short bandy legs, and arms extending almost to the knees. They live chiefly on roots and honey, have no fixed dwelling-places, but sleep between rocks or in caves

* Sir John Lubbock, "Origin of Civilization," p. 5; quoted from Moor's "Notices of the Indian Army," p. 49.

near which they may happen to be when night comes on.* Du Chaillu describes a similar pygmy race in Africa, the Obongos, as does Schweinfurth still a third, the Akkas, while the Dokos of Dr. Krapf are scarcely superior. The Juángs of India, if they be not identical with the race described by Mr. Bond, are not much above their level. They are said to have "no word for a supernatural being, no idea of another life, no ancestor-worship, and no fetichism." † Among other very low savage races may be mentioned the Fuegians, who, though of rather large stature, are mentally little superior to animals; the aboriginal Australians of the interior, who, along with other simian characteristics, are nearly destitute of the fleshy muscles constituting the calf of the leg (*gastrocnemius* and *soleus*); the Papuans, Hottentots, Bushmen, Andaman-Islanders, Cayaguas or Wood Indians of South America, the aboriginal Californians and root-diggers of the Rocky Mountains, and the Esquimaux. Many of these tribes and races live almost entirely after the manner of wild beasts, having nothing that can be called government, religion, or society. In the north of Ashantee is a race remarkable for an extraordinary growth of the cheek-bones under the eyes. "It is in the form of horns on each side of the nose, and so long that in some instances the man had to squint violently to see at all." ‡

Not only do many human races approach the animals in mental and physical qualities, but there are many convincing facts which indicate the descent of man from the ape family. In Hottentots, at least in some, the nasal bones are completely ossified, so as to leave no trace of a suture; this fact is not found in ordinary men, but is the normal condition of monkeys and apes, even the young ones. The arms of

* See annual address of Judge Charles P. Daly, before the American Geographical Society, 1876, quoting Mr. Bond, of the Indian Trigonometrical Survey.

† Spencer, "Principles of Sociology," p. 341.

‡ Daly, *loc. cit.*

negroes, as demonstrated by exhaustive observations made by Gould, Broca, Pruner Bey, Lawrence, and others, are relatively longer than those of Europeans. The difference is much greater in all the families of apes.

The perforation of the humerus, which is the normal condition in the apes, rarely occurs in Europeans, while it is found in nearly one third of the humeri of the American Indians. In most men, even Europeans, there exists a muscle, the *extensor coccygis*, which is a vestige of that which raises the tail of all animals that have one. In the tailless apes it is less rudimentary, and is more rarely wanting.

Human paleontology furnishes us still more conclusive proofs of man's simian origin. The platycnemic tibia, rarely found in advanced living races, but more frequent in certain low savage tribes, is of so common occurrence in the fossil remains of great antiquity, that its prevalence among the men of those ages is no longer questionable. Broca shows that such tibiæ are direct approaches to the ape, and that, in addition to the flattening, "the bone is sometimes bent, and is strongly convex forward, and its angles so rounded as to present the nearly oval section seen in the apes." This peculiarity has not only been found in the fossil remains of Europe, but also in America, where Mr. Henry Gillman has found the flattest tibia ever recorded.

A still stronger evidence of man's descent from the lower animals, and particularly from the apes, is furnished by the phenomenon of microcephalous idiots. Such monstrosities, though rare in civilized nations, sometimes occur, and they are now believed to be cases of reversion to the ancestral type. This opinion is founded on extensive and systematic study of large classes of facts. Professor Carl Vogt, who has given this subject years of close study, and has published the results of his observations in his celebrated "Mémoire sur les Microcéphales," comes to this conclusion. Among the peculiarities generally accompanying microcephaly and pointing in this direction are, that "the convolutions of the brain are less complex than in normal men, the frontal sinus or projection over the eyebrows is largely developed, and the jaws are prognathous to an *effrayant* degree, so that these idiots somewhat resemble the lower types of mankind. . . . They can not acquire the power of speech, and are wholly incapable of prolonged attention, but are much given to imitation. They are strong, and remarkably active, continually gamboling and jumping about and making grimaces. They often ascend stairs on all-fours, and are curiously fond of climbing up furniture or trees." * Microcephalous skulls are of quite frequent occurrence among the fossil remains of prehistoric man found in different parts of the world. Considering the paucity of such remains thus far discovered, the number of microcephalous crania found among them indicates with positive certainty that these monstrosities were many times more numerous in proportion to the general population than at present, which harmonizes perfectly with the general law that reversion diminishes in frequency in proportion to the degree of removal from the ancestral type. Microcephaly is furthermore closely correlated with the flattening of the shin-bone, and the extreme case of the latter from the mounds of Michigan, above referred to, was also microcephalous. A microcephalous idiot is simply an animal with the human form. Such creatures fall under the dominion of man, the same as domesticated animals. They can be taught to play tricks, obey commands, "know their names," and do certain kinds of service, the same as a dog or a horse. If they are cases of reversion, the animal to which they revert must have resembled them in many respects, although not necessarily so closely in other respects as in the brain and skull.

Embryology further corroborates the theory of the descent of man in direct line from the apes, and through these from the lowest forms of life. The coccygeal bones in the adult human being are closely grown together and immov-

* Darwin, "Descent of Man," vol. i, p. 117.

able, but in the embryo at a late period they are free, and constitute a true caudal appendage. The relative proportion in the length of the arms and body is not the same in fully developed persons as in the fœtal stages, the arms being then much longer, which is the special peculiarity of all the tribes of monkeys. The human fœtus from the fifth to the seventh month is covered with hair. In new-born infants there is little difference in the facility with which the hands and feet can be used, and the efficiency of the great toe as an aid to grasping is not greatly inferior to that of the thumb. It has, in fact, been shown by dissection that all the muscles by which the apes move the thumbs of their feet for grasping, etc., are actually present in the human subject, though atrophied and nearly obliterated by long disuse.

But embryology does not stop with demonstrating man's simian origin. The course of development of the race is repeated in that of every individual. This wonderful recapitulation by the growing embryo of the steps through which the race has passed in its development from the lowest forms of life is so vivid that many of these stages can be distinctly recognized. This is unquestionably the most important truth in biology. Not only is the ape-stage of man's development clearly recognizable, but also many lower ones. Below the marsupial and monotreme stages, during which important physiological changes take place corresponding to the peculiar characteristics of the animals of these families, there is a reptilian stage, and a piscine stage. In these, not only does the embryo greatly resemble these creatures, but its internal organs have the form which the latter preserve through life. In the fish-stage the human being possesses the undoubted homologues of gills and swimming-bladders, which are subsequently transformed into lungs and other organs.

Facts like these, equally with those of geology or astronomy, are calculated to carry conviction in spite of all efforts to escape it. They are their own arguments, and only require to be accepted as facts. It is ignorance of such facts, or doubt as to whether they are really established, which most strongly stands in the way of the popular acceptance of man's animal origin.

The effect of science upon philosophy is to simplify it, to bring it down from the clouds to the earth, to incarnate it, to dispel the mysticism that enshrouds it, and establish it upon a basis of reality—in a word, to materialize it. The facts of science are multitudinous and hard to find out, but when obtained they are always simple, rational, intelligible. So plain and homely are they that, when acquired by long and diligent labor, the world is not satisfied with them. They do not come up to its ideal standard reached by pure intellectual contemplation. The ideas of things before the facts have been worked out are always tinged with many-colored hues and trimmed with a golden border. This comes of poetic imagery common to mind itself. It is this that makes all truth so unwelcome when it is first announced. Truth comes unadorned. It is straightforward, plain, and reasonable. Therefore it does not satisfy.

Now, nothing could certainly be more reasonable, in the light of the facts within the range even of ordinary observation, than that the human race has descended by a very long course of very gradual modifications from the family of apes which resemble it in so many respects. But this is an unwelcome truth. It is too coarse an idea. Men want to be descended from gods. Animal ancestry is too simple.* They can see how this might be. Some families trace their pedigree back through many generations. The conception is perfectly intelligible. The world demands an origin that can not be comprehended. Then, again, and there is no use in qualifying it, man is ashamed to admit that he has descended from apes. Every educated person knows that he

* The very resemblance of the apes to men, instead of being an aid, is a hinderance to the truth. *Simia quam similis turpissima bestia nobis.*—Ennius, lib. xi.

has descended from the inhabitants of Europe, or Asia, or Africa, when nothing analogous to what we call civilization existed there. No one claims that his ancestors have been created since the historic period. In fact, every body knows that, if he could trace his pedigree far enough back, he would find his ancestors to have been barbarians, even savages. But what is the pedigree of the savage? Anatomically, as Huxley has shown, the ape tribes are more widely separated from one another than man is from the nearest of them. And, although the lowest men do not differ from the highest physically as widely as they do mentally, still, the different races are sufficiently distinct to be classed as so many species, and some very eminent anatomists, among whom was Professor Louis Agassiz, maintain that their differences are so great as to preclude the possibility of their having had a common origin. This opinion may, however, be now regarded as overthrown, and the monogenetic origin of all human races established, and this to a great extent independently of anatomy and on philological and chorological evidence. But, if all races have had one origin, then the origin of the European is the same as that of the Hottentot or the Papuan. Archæology emphatically denies the existence, in any known part of the earth, of any such race as the European prior to our historic period. If such had been the case, we should, as Sir Charles Lyell almost facetiously says, constantly find evidences of his existence in the shape of railroad-iron, steam-boilers, anvils, anchors, cog-wheels and other machinery, and all the materials of modern civilization.* And we might suppose that, if the lowest savages were degenerate descendants of such a race, they would at least preserve some traditions of their former greatness. But no such exist.

That there are low races of men whose present condition is due to a long course of degeneration from a once far higher state is not only possible but even probable; but, if this is

* "Antiquity of Man," p. 379.

ever proved, it will be by the discovery, among such tribes, of traditions of that higher state so definite as to render escape from this conclusion impossible. Intermediate or transition states, too, will be likely to appear in such cases. But the greater part of the savage races found inhabiting different parts of the world do not bear any adequate evidences of such degeneration. They appear to be true children of Nature, products of the cosmic forces at work in the organic world. Whether they are now stationary or are still continuing the work of development which has brought them where they are, it is difficult to determine, owing to the secular character of all changes in the organic world. At any rate, they seem to represent the highest development yet attained by the men of their line. Their past is not higher, but lower and more nearly assimilated to the animals over which many of them have as yet scarcely acquired dominion.

It may be safely given as the opinion of those naturalists who accept the animal origin of the human race, that at some time and in some part of the world some one group—it may have been a very limited one—of the ape family acquired certain of the characters which now distinguish the human from the simian anatomy. These characters are few, and may be thus summed up: Increased capacity of the cranium and increased size of the encephalon (a quantitative distinction only, and therefore anatomically of very little weight); greater complication in the mechanism of the larynx; the erect posture of the body; the plantigrade character of the feet; non-opposability of the great toe; diminished length of the arms in proportion to the trunk; greater or less absence of hair from most of the body and limbs; double curvature of the spine.

These and a few other minor distinctions constitute all that separate the man from the ape, so long as we confine ourselves to the physical aspects. An examination of these points reveals a certain dependence among them all, so that, on the principle of direct adaptation, they would all flow from some one or two of the chief ones. In fact, from the first-named distinction it can be shown that all the others, as well as all the secondary qualities which so much more widely distinguish man from the animals, may have resulted.

The fundamental postulate, in attempting to account for any form of organic development, is the tendency of all organs at all times to vary in all directions. This tendency is constantly held in check by the counter-law of heredity, by which the offspring tend to resemble the parents in all respects. The very facts which have made any particular form a success, *i. e.*, have enabled it to exist, are constantly co-operating with the law of heredity to check the tendency to variation. The possibility of the existence of an organism of a given form is a partial negation of the possibility of an organism of a slightly different form. Such forms are presumed to have been tried and to have failed because not advantageous. But, while organic forms are constantly kept within this narrow groove by the double action of these forces of heredity and selection, it is also true that variations are occasionally occurring which, either because they never have been before tried or because tried under conditions which have since changed, prove clearly advantageous to the organism. Variations of this nature, instead of being pruned away, are preserved and perpetuated, and, in proportion to the degree of advantage gained by the variation, not only that degree of variation, but also the number of individuals bearing it, will be increased. It is believed that nearly all organic progress can be explained on this law. It is a mistake to suppose that such progress is continuous and uninterrupted. It resembles more the mode in which an army moves upon an intrenched enemy. After reaching one secure position, it rests for a time, to prepare for the next advance. This may not be a directly forward movement. It may be by the flank, with a change of base and of front, so that the enemy will appear to be encountering an entirely different force. But each move is in the direction of advantage. So the organic life of the globe has advanced by irregular, successive stages, with irregular intervals of stagnation and frequent partial retreats, many changes of base and of front, and all in accordance with the nature of the conditions which have existed in the case of each organism at any given time.

Applying this general law to the transformation of the anthropoids to men, we may, and, so far as I can see, must, assume that the particular form of variation which escaped the pruning process in the first instance was that which affected the mass of the cerebral hemispheres. In the anthropoids the arboreal habits of the majority of monkeys have in great part disappeared,* the size of the animals alone being sufficient to render it precarious and disadvantageous. Already, with the more or less complete adoption of terrestrial habits, a long step had been taken in the direction of attaining the erect posture. If we suppose the true *Anthropoides*, or simian primogenitor of the human race, to have combined in his physical form the several characters in which the anthropoids and other apes most resemble man—viz., the full chest of *Hylobates*, the gibbon; the skull of *Engeco*, the chimpanzee; the short arms and man-like hands and feet of the gorilla; the size of brain of *Satyrus*, the orang-outang; and, perhaps, the facial features of *Semnopithecus*, *Cercopithecus*, or *Mormon*, together with other less prominent characters approaching the human anatomy—we shall perceive that the step to be taken will be considerably abridged from that which now actually separates man from any one of these forms. And there can be no valid objection raised to such an assumption. That such a form once existed is as

* The orang still inhabits trees, but its movements among their branches are described as very slow and labored. (Paper by Mr. Hornaday before the American Association for the Advancement of Science, at Saratoga, 1879. "Proceedings," p. 447.) The gorilla, on the contrary, has already nearly or quite forsaken the trees, and lives in jungles, using its fore-limbs to hold on to the smaller growths.

probable as that the gorilla or orang should exist. True, we have no living representatives of just this form, but neither have we probably any living representatives of the form then contemporary with this supposed *Anthropoides*, and from which the orang, for example, may be supposed to have developed. As there existed then no true men, so there existed then no true gorilla. None of the forms now in existence correspond with any then living. All have changed, and we have the anthropoids on the one hand and man on the other. These have all doubtless had a common progenitor, if we go far enough back; but this may have been, and doubtless was, long anterior to the development of *Anthropoides*.

It may be urged that we have no fossil remains of this assumed progenitor, which is true; but neither have we any fossil remains of the progenitors of the living anthropoids. All the higher simian forms are of late tertiary time, and this formation is very poor in fossil remains. Besides, the regions of the world in which all facts show that they can only have existed have never been studied by paleontologists, and we are as ignorant of what treasures may remain in store for this branch of science in Central Africa, Southern, Eastern, and Central Asia, as we were of those of the Great Plains of Montana and Wyoming a century ago. There is, therefore, no reason to despair of finding the "missing link," so long as the pliocene and post-pliocene of those regions remain unexplored by competent paleontologists.

Setting out, then, with our *Anthropoides*, a true ape, as above described, living mostly on the ground, walking partially erect by holding on to the small undergrowth of the forests and jungles, even as the gorilla is known to do, we have but to assume a tendency to vary in a single direction, to see worked out before the eye of the mind all the remaining changes necessary to complete the transition to full manhood as we find it among the lowest human races. This variation must have been in the direction of increase of brain. *Pari passu* with the increasing organization of the *Vertebrata* has gone on increasing mass of brain. From the *Amphioxus*, in which no enlargement of the spinal cord takes place at the anterior extremity and no cranium exists, to the fishes, the reptilia, the mammalia, and throughout the ascending grades of these latter, this process of *cephalization* has constantly kept pace with the general degree of organic development, not always in exact proportion to the latter, but in a sort of corresponding parallel series. It has reached its highest expression, at the extremity of several lines, in the horse, the dog (wolf), the elephant, and the ape, particularly in the orang-outang. We may suppose that the mass of brain in *Anthropoides* was equal to what we now find it in the orang, whereby the former would have the advantage of the latter by a truly immense period of time; and, therefore, among the valid reasons to be given for man's supremacy would be that he has had the start of all other creatures, chronologically speaking, and therefore has held the field.

Under the law of Natural Selection, everything is an advantage which serves to protect individuals from destruction from outer enemies, both organic and inorganic, or which enables them better to secure the means of subsistence. A race of large apes living in the vast forests of Central Africa or tropical Asia, where lions, tigers, leopards, and many other large and ferocious carnivora abound, would be the constant prey of these beasts, and especially liable to have their young carried off and devoured, thus rendering the existence of the species precarious. Lacking most of the means of defense as well as of escape necessary to prevent destruction from such creatures, the only substitute possible for these is increased sagacity or cunning in outwitting their enemies. But increased sagacity can only come of increased brain-mass in relation to size of body. These creatures must have constantly found themselves "put to their wits' end" to devise means of preventing such attacks, and we seem fully justified in supposing that, from the recurrence of such efforts, in which bodily efficiency was not, and mental efficiency was, solely relied on, the development of the cerebral lobes went on rapidly under the law of direct adaptation. But, from the increased protection thus rendered both to adults and to offspring, the number of the latter enabled to survive was increased, and these inherited the increased brain-power of their parents, and again transmitted it, with an additional increment, to their offspring.

In addition to this negative influence, which was perhaps the strongest, there was also the positive influence exerted in the same direction in the struggles of these creatures for the means of subsistence. The discontinuance of their arboreal habits put a vast amount of their natural food beyond their reach. The rich nuts that hung from the branches of tall trees, the dates and other delicious fruits of the palm, the plantain, and the banana, must now be watched till, ripened by time, they fall to the ground, if happily the lesser monkeys, the squirrels, and the bears have not already devoured them all. These losses must be made up. This can only be done by increased cunning; and here, again, the direct impulse to further brain-development is exerted. From these two influences acting in the same direction, aided by natural selection, the entire amount of cerebral increase, with its corresponding cranial enlargement, necessary to bridge over the chasm between the true ape and the true man, between the highest animal and the lowest human brain, can be readily accounted for without exceeding the time-limits within which geology requires this differentiation to have taken place.

It remains to consider how, from this one alteration in the animals' form, all the other differences between apes and men would naturally, if not necessarily, follow. Take first the completion of the erect posture, already so far carried on in consequence of the change from an arboreal to a terrestrial existence. The argument that the increased weight of brain, by placing too great strain on the muscles of the neck, tends to raise the head to a position more nearly on a line with the axis of the body, in which it is more easily supported, is not without great force. An increase of weight in the brain-substance alone of from two to three pounds is no small consideration in itself, when we remember that a horizontal animal must carry this mass at a right angle to the vertical axis, and this extended from the body to a greater or less distance. But the weight of the cerebral substance is probably much less than half of the real increase of weight to be sustained. The bones of the head must be correspondingly enlarged, and, being nearer the circumference, the increase of mass is larger in proportion. Then the whole head must undergo a similar enlargement, so that the contrast is not at all exaggerated when we compare the head of a microcephalous idiot with a normal human head. Under this constant influence there can be no doubt that there would be a gradual adjustment of the head to the position in which it is most easily carried—that is, vertically over the spinal axis.

If it be asked why the same is not the case with other animals, the answer is, first, that the weight of brain is never so disproportionally increased in these; and, secondly, their habits of life, as well as the entire use of all four of their limbs in the act of locomotion, forbid any such transformation. In other arboreal animals whose fore-limbs are still employed as true legs, as in the squirrels, a transition from the life in trees to one on the ground would result in the greater assimilation of the fore-legs to those of other ground animals, which has perhaps been the case with some rodents. In such cases the change tends to make the animal more strictly a *quadruped.* In the ape family, however, so different is their mode of climbing, and so dissimilar the nature and conformation of their anterior extremities, that it might be supposed *a priori* that the course of differentiation would be in the opposite direction, and that, on the discontinuance of arboreal habits and the adoption of terrestrial ones, the modifications of structure necessary to adapt the animal to the new mode of existence would be such as to render it essentially a *biped.* Both the fore- and hind-limbs of a monkey are very poorly adapted to locomotion on the ground, but, as the use of the hind-limbs for this purpose would be wholly indispensable, the only question would be that of the modifications which the fore-limbs would be likely to undergo. Already admirably adapted for prehension and for the conveyance of food to the mouth, and constantly in use for a great variety of other acts analogous to those for which men employ their hands, it is to be expected that when no longer used for climbing they would still further come into use in the performance of these latter acts. This would be all the more natural where the new mode of life was to be led in the midst of a tropical forest, where the dense growth of underbrush, vines, and trees would often be so great as to render it impossible for a man to penetrate it.* Here the fore-limbs, previously so serviceable among the branches of the trees, would be no less serviceable in holding on to the smaller growths, and thus supplementing the awkward movements of the hind-limbs. Even without increased brain-development, the natural tendency under such circumstances would be toward the development of true hands as well as true feet. But, when the protection of the animal's life from stronger enemies, as well as the supply of food to maintain its subsistence, came to depend upon strategy, craft, cunning, and all the forms of mental superiority, then it would be that free and *dexterous* hands would be of the greatest service. We rarely reflect what an immense advantage man has over the other animals in being able to perform the acts of locomotion by means of only two of his limbs, leaving the other two free to be used for a thousand other purposes. While we may lament that man has not been endowed with wings with which to navigate the air and defy all obstacles upon

* See Humboldt's description of a South American forest, in "Das nächtliche Thierleben im Urwalde," "Ansichten der Natur," S. 156, 157.

the earth, we may find some consolation in the fact that the wings of a bird are the homologues of our hands, and that they have no other substitute. If any one were obliged to take wings at the expense of his hands, he would doubtless prefer to be wingless. And it is a suggestive thought, though doubtless the naked truth, that man owes his hands to the circumstance that the primordial ancestor of his line, at the base of the mammalian class, was forced to inhabit the trees. Hands were not originally made to wield the pen or the hammer, or to hold the plow, but to grasp the limbs of the trees in the vast wildernesses of the tropics, and enable their possessors to live among their branches. In this strictly arboreal life there were many uses to which the hands were put besides those of simple climbing; but when brought down to earth, where the primary function could no longer be exercised, the secondary ones came to assume the chief importance, and continued to increase in number and variety until they reached the condition now taken by the human hands.

But what, it may be asked, has all this to do with the erect posture? Every thing. With all tendency to "go on all-fours" removed, and with the feet capable of sustaining the body without the hands, there was nothing to lose and every thing to gain by the adoption of a vertical position. The art once fairly acquired of balancing the body on the hind-limbs alone, and of progressing thus balanced, with the hands free to perform all other services required by the surrounding conditions, the habit of bringing the entire spine into a vertical line would soon be attained from an unconscious compliance with the mechanical conditions of equilibrium. The effect of increased brain-development would be to make the hands more and more serviceable as auxiliaries in defense, in the procuring of food, and in the various higher forms of exercise, such as are characteristic of the hands of men, and to withdraw them more and more from duty as instruments of locomotion. The whole of this influence would be exerted in the direction of establishing the erect posture.

All that has been said of the differentiation of the hands and their specialization for the high purposes of existence as a means of bringing about the erect posture is equally true of the specialization of the feet for purposes of locomotion. In the arboreal state both pairs of limbs were adapted for grasping. Both were provided with distinct opposable thumbs, and could be used indifferently for most of the actions which an arboreal life required. On the change to terrestrial life these qualities in the forward members were increased and intensified, while in the posterior ones they fell into disuse, and became gradually more and more atrophied until the opposability of the great toe was finally lost, and the entire foot underwent so complete a transformation that it has required the closest anatomical study to work out the homologies. That this has, however, been done, we may state upon the highest authority, that of Professor Huxley. While the hands and feet of men seem to differ so much more from each other than do the fore and hind hands of the apes, it is now made clear that the distinction is functional or physiological only, and not morphological. In point of fact, the fore and hind limbs can not be homologically compared either in men or in apes, not being constructed alike, although the hind-limbs of the apes are homologous with the feet of man, as their fore-limbs are with his hands. The resemblance in the apes between the fore and hind hands is due to the specialized form which differently constructed organs have assumed in virtue of the similarity in the functions which their mode of life required them to perform. The subsequent differentiation of the feet of man, on account of a change in those conditions in which hands and feet were called upon to perform entirely different functions, was perfectly normal, and represents rather a partial return to the original type than any wide deviation from it. Certain it is that increased brain-development, by originating new uses for the hands incompatible with their functions as aids to locomotion, tended, by the same amount, to restrict the feet to the sole performance of that function, and thus contributed to the establishment of the erect posture which is alone in harmony with the mechanical conditions of a two-legged animal.

The only other prominent consideration to be added is that which concerns the vocal organs, and, although it must be confessed that no more important faculty exists than that of speech, and that while this is common in some form to all known human races, and, so far as known, is absent from all other animals, so as to be properly regarded as one of the leading distinctions which separate man from all other forms of life, still the readiness with which the development of the vocal organs follows from the primary condition of increased brain-mass renders this character, properly viewed, one of the easiest to account for on strictly natural principles.

Nearly all mammals possess a well-developed larynx, and in most of them it is employed for precisely the same purpose as is that of man, viz., to create audible sounds which convey a definite meaning to others. This may, in its ultimate analysis, be regarded as the definition of speech. On this view, all animals capable of conveying an idea, however simple, by means of a vocal sound, however rude, may be said to be possessed of speech. But this would equally apply to insects which produce sounds by various forms of stridulation not at all analogous to vocalization. For these have a definite object in view, and their calls are successful in securing this object. Remarkable differentiations in the larynx are common in many vertebrate forms. The amphibians have a well-developed larynx, and most of them utter loud and shrill notes. In toads there is a loose membrane adjacent which can be greatly inflated, and which thus assists in the production of the loud and disagreeable sounds which these creatures make at night. The *Reptilia*, singularly enough, are for the most part silent; but the birds, which have undoubtedly descended from them, present some of the most remarkable laryngeal developments furnished by the animal kingdom. The musical powers of birds are due to this fact, and here the vocal cords are variously modified to produce the results. In the whooping-crane (*Grus Americanus*), and also to a less extent in the sand-hill crane (*G. Canadensis*), there exists, in addition to the regular vocal organs, an exceedingly long tube connected with them, and consisting of the trachea incased in a mass of ossified tissue, and coiled several times round to increase its length. This tube serves to intensify the sound, and gives it a peculiar tone which can be heard at an immense distance, and long after the aspiring bird in its vast upward cycles has been lost to view.

In most mammals the ability to multiply and vary sounds is generally much limited, which is supposed to be in great part due to the imperfect nature of the sonorous cavities adjacent to the larynx rather than to the imperfection of that organ itself. M. Emile Blanchard thinks that, but for this, dogs would be found to possess a considerable degree of speech. In the monkey tribe the larynx is highly differentiated, and does not seem to be much inferior to that of man himself. There is great variety and doubtless much expressiveness in the chatter of these creatures, and some monkeys are capable of uttering sounds of immense volume, as the so-called "howling-monkeys." But the anthropoid apes seem to be for the most part silent, and make little or no use of the highly developed vocal organs which they possess. Mr. Darwin claims that this is not by any means a solitary instance in nature, and names various birds whose vocal apparatus seems to be equally elaborate, some of which, as the crow, merely croak, while others pour forth rich and varied melodies.

But, although, as we have seen, various creatures employ their vocal apparatus for definite purposes analogous to those for which man employs his, still it is beyond question that man is the only being on the globe that has advanced to the point of employing arbitrary signs to embody ideas which they do not naturally suggest, and of uniting many such into connected articulate speech. But, in viewing this apparently salient distinction, we must, as heretofore, resist the tendency which constitutes the chief fallacy of all attempts to compare man with the lower animals, to contrast wide extremes while ignoring intermediate facts. Barely referring to the fact that the genetic study of human language leads to the belief that thousands of words now wholly arbitrary have grown out of original sound-words, or onomatopœia, we may note that the languages of certain living races scarcely rise above this level. That gesture-language preceded sound-language, or developed *pari passu* with it, there is much evidence, and in many of the lower animals it is far more expressive than the scanty sounds which they can alone make. There exist at the present day races of men, as the Zuñi and Arapaho Indians, or the Bushmen, who depend so much upon gesture, it is said, that they can only with the greatest difficulty convey the simplest ideas by speech alone, or in the dark.*

The great relative imperfection of the languages of various savages has been repeatedly pointed out by ethnographers and philologists. Many lack the verb "to be" entirely. There are no general or abstract terms, and all nouns may be said to be *proper* nouns. While the Shoshone Indians have long holophrastic words to express various kinds of going, such as going-on-horseback, going-on-foot, going-over-the-mountain, and still more compound ideas, they have no simple word "to go." Then, again, as the vocal organs are capable of making a great variety of sounds, we find that those of savages do not necessarily conform to the euphonious ones

* Spencer's "Principles of Sociology," vol. i, p. 149. This statement has been denied of the Arapahoes by persons well acquainted with that tribe (Colonel Garrick Mallery, in "Annual Report of the Bureau of Ethnology," 1879–'80, p. 314); it is also now known to be untrue of the Zuñis, who have a highly developed language.

embodied in cultivated languages. Words are often the merest grunts or clucks, and in some languages it would be impossible to spell out the pronunciation of many of them.* These crude, undifferentiated sounds can scarcely be called words, and yet monosyllabic words all rest on very similar claims. It may be truly said that there are human languages which are not articulate, or, at least, which are no more so than are the various sounds expressing ideas which certain of the lower animals are capable of making. All, therefore, that can still be said in favor of language as an exclusively human attribute is, that even the crudest human languages contain a somewhat larger number of expressive sounds than can be marshaled by any other animal.

The amount of actual modification which the larynx of man has undergone is very slight compared with the progress made in speaking. It is probable that, with their present organs and the proper incentive to their exercise, the higher apes could utter all the sounds embraced in some rude languages. Practice alone is all that would be needed to adapt the organ to the function, and, according to the law of direct equilibration, or morphological adaptation produced by use alone, the highest perfection in the form of the organs themselves might be reached. The condition required, however, is *the incentive to practice.* This is the result of a variety of circumstances, none of which would avail without a certain degree of mental development, or intelligence, as the primary and initial condition.

The degree of sagacity amounting to actual intelligence, which we so frequently observe in domestic animals, particularly in the dog, is still far short of that required to initiate articulate speech. The suggestion of M. Emile Blanchard that certain animals, as monkeys, would probably have been able to communicate orally with man, but for a defect in the buccal cavity and other sonorous passages, which differ more in man than does the larynx itself, is worth considering, but upon

* Tylor, "Primitive Culture," Boston, 1874, vol. i, p. 170.

the whole it seems that the true cause of the deficiency lies in the brain.

If a microcephalous idiot, with from fifty to sixty-five cubic inches of brain, can not be taught really to speak like other men, although possessing all the organs employed in this process exactly like other human beings, it can hardly be expected that the chimpanzee, with nearly the human stature and only thirty-five cubic inches of brain, could be taught to talk, even if all its organs were precisely the same. And this may be taken as a fair type of the relation between brain and size of body among the most intelligent of the lower animals. The full consideration of this subject brings out into greater and greater prominence the salient fact that it is his disproportionate brain-mass, even among the lowest savages, that makes man to differ from the rest of the animal world, and that out of this one fact, as a sufficient primary *datum*, all other distinctions naturally grow. Indeed, when we give due weight to this factor, we are forced to concede that not only is it sufficient satisfactorily to account for all the collateral results, but that, following up its natural genesis, precisely such results must necessarily be evolved.

While increase of brain is the efficient *cause* of so many other prominent qualities which are regarded as strictly human, this increase must also be regarded as an *effect;* and one of the chief causes, which along with others have conduced to it in the primordial animal state of the race, has undoubtedly been the tendency to *associate*. But, again, this tendency itself may not have arisen as the most powerful causal influence until the long secular effect of other less powerful causes had carried the process of brain-development to that point from which the mutual advantages of such association to the maintenance of the species had begun to be perceived. Thus have all the varied influences mutually aided one another, now appearing as causes and now as effects, until the result which we find has been reached.

I have spoken of brain-mass without mentioning any qualitative development as attending this quantitative one. There is no doubt, however, that the brain has not only *grown*, but that it has also *developed*. Along with increase of mass there has undoubtedly gone increase of structure in the brain as well as in all other organs, and in organisms in general. This fact, while it has many valuable bearings, is especially effective in explaining one of the chief difficulties in the way of the theory of man's descent from the animal world below him.

The opponents of this theory are fond of alluding to the fact that among savages, and even among the remains of prehistoric man, crania of large capacity are frequently found, and also to the fact that the average cranial capacity, even of the smallest-headed races, is greatly disproportional to that of the anthropoid apes which approach or exceed the human stature. Mr. A. R. Wallace concludes that "the average cranial capacity of the lowest savages is probably not less than *five sixths* of that of the highest civilized races," and he cites cases in which the brain of an Esquimau measured 113·1 cubic inches and of an Australian that measured 104·5. To these cases might be added many in which acknowledged mental powers were manifested by brains of small capacity. In so far as these cases are exceptional they are of little value, but there remain certain results that are relatively constant on taking the average of numerous observations, which still show that the degree of brain-increase is not in any direct proportion to the degree of intelligence. This fact, however, admits of a number of qualifications in addition to the important, and, as it would seem, sufficient consideration already named, which ascribes the disproportion to a qualitative differentiation, which, in harmony with the general laws of biology, is the constant concomitant of this quantitative increase.

As regards other qualifying considerations, it may be urged that the doctrine of the causal dependence of intelligence upon brain-mass does not imply that any definite ratio subsists between them, much less that the increase of the one must be directly proportional to the increase of the other. The most that it predicates is, that the former is a *function* of the latter, and the law of the relation between the two variables must be determined by the observation of facts.

The amount of intelligence to be manifested by a given brain capacity is no more to be determined by direct calculation than is the "power" of a steam-engine by its size. And yet in the one case as in the other there is a *relation* between them, and this relation is in the nature of an "increasing function."

Intelligence, regarded as a something to be increased and diminished, multiplied and divided, certainly can not be so dealt with in connection with brain, any more than dollars can be added to ounces or bushels multiplied by yards. It is, therefore, impossible to say how much the intelligence ought to be increased for a given increase of brain. We can only point to the facts, and assert that the vast and incalculable difference between the intelligence of the average European and the average Australian has been due directly or indirectly to an increase on an average of twelve cubic inches of brain, or about seven per cent. Mr. John Fiske * has ingeniously compared this accelerated increase of intelligence to a geometrical progression whose first doublings for a long time produced comparatively small effects, but which reached large numbers when history began, and made a grand stride with the advent of science. The increase of the brain may thus be said in a certain rude sense to be a "logarithmic function" of the development of the mind. And as, in the case of small and large cubes, equal increments added to the respective edges produce very disproportionate amounts of increase in their volumes, so equal increments added to undeveloped and to developed brain respectively yield immensely disproportionate amounts of intelligence.

But another important qualification of the general facts

* "Outlines of Cosmic Philosophy," vol. ii, p. 296.

here considered should not be, although it usually is, disregarded. Intelligence is not a simple attribute, but a compound one. It may be resolved into two distinct factors, intellect and knowledge (vol. i, p. 405; vol. ii, pp. 471, 474). A full discussion of this analysis belongs to the second volume of this work (chapters xiii and xiv), but it should be noted here that an immense amount of what is ordinarily accredited to brain belongs to education. Civilization does not make its successively increasing strides by virtue solely or principally of increased brain-development, but rather because the brain-work of ages has accumulated, and the effects are again multiplied. Labored essays have been written to prove that the so-called "Ancients" were endowed with intellect even superior to modern men. Certainly as between ancient Greece and modern Europe there can have been but slight increase in the mere co-efficient of intelligence. The rest is due to accumulated knowledge wielded by at least equal intellectual powers. It is upon this fact that the principal claims of this work are based, and the chief object in writing it has really been to show that the influence of knowledge as compared with that of intellect, in securing for the human race the satisfaction of its wants, and in leading it to higher desires and their equal gratification, has been vastly underrated; and also to show that, in paying greater attention to the former, which is under man's control, and less to the latter, which results from the subtile laws of selection, the end most desired—viz., increase of intellect—will itself be far more rapidly and certainly attained (vol. ii, pp. 483, 549).

Connected with the discussion of the origin of man there are three questions which usually arise, and which have been variously answered according to the stand-point of different individuals, and to the real degree of information possessed, bearing legitimately upon them. Such questions are: first, whether the race originated in one spot at one time, or has had several distinct places and times of origin; second, in what part of the globe these one or more beginnings took place; and third, how long ago man appeared on the earth.

As all these questions must be settled, if ever, by the logical deductions which can be made from known facts of anthropology, considered as a department of biology and as a subdivision of zoölogy, all discussion of them prior to the development of a body of such facts was utterly nugatory.

With regard to the first one, or whether there is more than one human race, or stock, science has alternately favored one or the other view according as the materials of evidence have accumulated. While the Linnæan and Cuvierian doctrine of the special creation and invariability of species prevailed, science pointed unmistakably to the multiple origin of the human race; and, as the deduction thus forced by logic upon the scientific world was diametrically opposed to the traditional belief, which, on the other hand, warmly supported the doctrine of special creation, it came to be more and more obviously impossible to subscribe to both doctrines, and the conventional scientist found himself in a sad dilemma. At last Professor Louis Agassiz came out strongly in favor of the doctrine of polygenesis,* and declared that the differences presented by the different races of men were too great to be explained as mere variations. They were specific, and the negro, the Caucasian, the Papuan, and the Mongolian, were species of the genus *Homo*, and as such must have had as many distinct origins.

This fiat, however, came too late, as the Lamarckian doctrine of descent had now, in the hands of Charles Darwin, so far won its way into the minds of scientific men that its complete triumph could not be arrested. And even the theological and non-scientific world, whose acceptance or rejection of such doctrines depends wholly upon their supposed practical advantages, and not at all on the evidence of their

* "Proceedings of the American Academy of Arts and Sciences," vol. iii, p. 6. See also his New York lecture on "Men and Apes," 1873.

truth, seemed to prefer the one which restored to them a united humanity, although it robbed them of a "golden age."

At the present time this theory of the descent of all the human races from a single primordial stock may be said to be the only one which possesses any degree of respectability either inside or outside of scientific circles. It can not, however, be denied that there are many valid arguments still unanswered in favor of the polyphyletic origin of man; and, although these may one day be satisfactorily answered, and the monophyletic theory be fully sustained, it is at least evident that the present harmony on this point is in great part due to the general satisfactoriness of a scientific theory in accord with received traditions. For scientific men, who consider that there are more vital questions to be settled, wisely deem it imprudent to agitate this unimportant one, which has already been settled, though perhaps only provisionally, but so settled as to diminish considerably the popular prejudice against the remainder of the theory.

From what has already been said, it will appear to all that the question which was formerly discussed, as to whether the race sprung from a single pair or from many such, no longer exists for science. It is simply a case of the development of a species by means of infinitesimal differentiations, so that no line of demarkation between man and animal could possibly have ever existed. The question as to who was the first man is equivalent to the question which was the first fan-tail pigeon or the first Durham cow. As Professor Haeckel justly remarks, we can no more say that the human race sprung from an original pair, or from several such, than we can say that the English race or the French race so sprung. The entire conception implies a *saltus* of which Nature is never guilty.

With regard to the next question, or the *local* origin of man, a great deal has been said and written. But even this problem requires to be definitely stated, which is seldom done, and its answer will undoubtedly differ according as the statement of the question differs. Here, again, arises the nice point, which, as we have just seen, admits of no absolute settlement, as to what really constitutes a man. At what place in the long line of gradual morphological transformation of the leading organs of the body shall we stop and say, On this side is manhood, and on that side is apehood? Until all can agree on some such point, no solution of any of the questions above proposed can be given which will satisfy all, nor could there be, even if all the facts were known. The mass of linguistic and traditional evidence which has been long accumulating, and which points to Southern or Central Asia as the center from which a large number of races, now ethnologically distinct, have at a remote period radiated and settled remote regions of the world, is valuable only as indicating the probable habitat of one of the primordial groups of mankind after the power of speech had been fully developed. But even the languages now understood by philologists are thought to indicate a multiple origin of speech among men, and this, if true, implies that, before articulate speech had fairly arisen, the *Pithecanthropi*, or *Alali*, had become separated into something like tribes, occupying separate localities, perhaps thousands of miles apart. If the question be, Where did man first begin to speak? the answer would seem to be, In several places, one of which may have been in Southern or even Central Asia. But, if we go back of this, and ask where the *Alali*, or non-speaking men, first acquired a sufficient erectness of posture and other physical characters to entitle them to be called human beings, or true *Homines*, to this question no answer can be given. The nearest approach to a positive declaration that can perhaps be made would be that most or all of these modifications must have taken place while the creatures inhabited warm or tropical regions, in which nature supplied the means of subsistence without labor either in producing or preparing them. Nearly all apes and monkeys are inhabitants of the tropics, and, although fossil remains of them, such as *Dryopithecus*, an anthropoid ape, have been found in more northern countries, still it is supposed from other evidence that a much warmer climate prevailed there then than now. It is not to philology or mythology that science must look for the solution of the question of the local origin of man, but to *paleontology*, and, before such a solution can be expected, this science must, at least, be prosecuted in the regions where those animals which most closely resemble the human form now exist.

As regards the third and only remaining question which it is proposed here to discuss, viz., that of the *antiquity* of man, so much has been said upon it that its consideration is introduced rather to preserve the symmetry of the treatise, than because it is presumed that anything new can be adduced.

But, notwithstanding the great extent to which this problem has engaged the attention of the most able writers, it may be doubted whether the point of view from which the discussion here proceeds has been sufficiently appreciated. For in this problem, as much as, if not more than, in those already discussed, is the solution complicated by the lack of a definition of what constitutes man. The period that elapsed between the time when he would have been separated by modern naturalists from the true *Simiæ* and that at which he or any of his tribes acquired the power of articulate speech, was probably vastly greater than all the rest of his subsequent career. If any time-measures of this period are ever obtained, they will be deduced from the comparison of fossil remains yet to be discovered, and of the geologic strata in which they shall be found. Not having yet been found, no paleontologist having yet systematically examined the regions where they can alone be expected to exist, there are, of course, no data on this important point. All opinions on this subject being, therefore, purely deductive, and based on inductions from later facts, they are far less reliable than those usually avowed respecting the antiquity of so-called prehistoric man, known to have inhabited Europe and America at the same time with the cave-bear, woolly rhinoceros, and Irish elk. Of the enormous period of time which must have elapsed between the prehistoric and the modern peopling of Europe, estimates in figures convey but dim impressions, and it scarcely matters that they should differ by several hundred thousand years. All attempts to measure so great a period in years must prove futile, and when a number is fixed upon, such as 800,000 or 1,000,000 years, the mind utterly fails to grasp the period thus expressed. The reader who has made himself a little acquainted with geological conceptions will form a far more adequate idea when the phenomenon is expressed in terms of geology. It is now certain that the earth has been the theatre of a series of secular changes of climate or alternations of cold and warm periods, either in both hemispheres at once, or, more probably, with the northern and southern hemispheres always in opposite states; but of the southern hemisphere comparatively little is known. The cold periods are known as glacial epochs, and already two such are satisfactorily traced in European strata. If caused by astronomic changes such as those which periodically occur in the eccentricity of the earth's orbit, in the revolution of the line of apsides and the precession of the equinoxes, whose rate is known, the exact time can indeed be calculated at which the maximum effect would be reached. This Mr. Croll has attempted to do, and places the period of last maximum glaciation at about 200,000 years before our era.

It is pretty well established upon paleontological evidence that man not only existed prior to the last glacial epoch, but that at that time he possessed some rude degree of art. But this is not all. Unquestionably, human remains have been found in both the Pliocene and the Miocene formations of the Tertiary period, which throw all numerical calculation into the background, and establish man as a product of geologic time. And this is developed man, with the large brain of seventy cubic inches, the plantigrade foot, the erect habit, and doubtless with the power of oral intercommunication—articulate speech. Further back into this dim and hoary antiquity, through the millions of years which it must have required to raise him from the speechless, semi-erect, half-quadrumanal state which he had even after his brain became large enough to entitle him to the name of man, it is both fruitless and unnecessary to peer.

CHAPTER VII.

TERTIARY AGGREGATION.

SOCIOGENY *—GENESIS OF SOCIETY—SOCIAL RELATIONS.

Logical position of the chapter on anthropogeny—Phenomena of sociogeny a continuation of the process of aggregation—Conditions favorable to association in the simian ancestors of man—Social statics and passive social dynamics—Necessity for realizing the import of the term social science—Analysis of its forces the initial step in establishing a new science—Preliminary consideration of the origin and nature of society—The four stages in the development of society—The social forces—Classification of the social forces—Genesis of society through the action of the social forces—Method adopted of treating the subject—The essential social forces—The preservative forces—Operation in the pre-social state—Become a factor with the recognition of property—Hunger and cold, *i. e.*, want, regarded as forces—Subsistence—Feeling, not function, the object of the social forces—Origin of art—Relation of the mind-force to the sense-force—Origin of industry—Property as a social factor—Genesis of avarice—The law of acquisition—The principle of deception—Natural justice—Transition from natural justice to civil justice—Influence of sympathy—Influence of increased intelligence—Influence of diminished power to acquire—Genesis of civil justice—Modes of acquisition—Classification of modes of acquisition—Producers—Classes of production—Primary production—Sources of food—Food distinguished from medicine and poison—Mineral foods—Organic foods—Nutritive foods—Respiratory foods—Vegetation the original producer of organic foods—Sources of vegetable food—Sources of animal food—Production of foods—Production of mineral foods—Production of vegetable foods—Production of animal foods—Secondary production—Arts practiced in obtaining animal food—Arts practiced in obtaining vegetable

* Fiske, "Outlines of Cosmic Philosophy," vol. i, p. 222. This term may be defended upon precisely the same grounds as was the term Psychogeny. Its heterogeneous (Græco-Latin) character, while it is admitted to be an objection, is only the same objection which lies against "Sociology," which has now received the highest sanction.

food—Art displayed in the preparation of food—Art required in providing clothing and shelter—Nature and sociologic importance of invention—Production of artificial appliances—Appliances for protection against climate—Art of making fire—Production of clothing and shelter—Production of clothing—Production of means of shelter—General remarks on production—Notions of value—Land—Degrees of production—Necessities *vs.* luxuries—Classification of the objects of production with respect to their degrees of utility—Accessories to production—Distribution—Transportation—Exchange—Finance—Distribution as a mode of acquisition—Parasites—Classification of non-industrial modes of acquisition—War—Government—Hierarchy—Monopoly—Monopoly of transportation—Monopoly of exchange—Monopoly of finance—Monopoly of labor (slavery)—Monopoly of manufacture—Remedies for monopoly—General observations on the parasitic classes—The reproductive forces—Comparison of the operations of the preservative with those of the reproductive forces—The physical aspect—Feeling *vs.* function—The direct effects—The sexual appetite—Anomaly of woman's sexual sentiments—Difference in the sexual instincts of males and females—Diffusion of the sexual instinct—Love—Sociological effects of the love-sentiment—Physical modifications—Social modifications—Male sexual selection—Marriage—Principal forms of marriage—Polygyny—Polyandry—Monogamy—General remarks on marriage institutions—Genesis of modesty—Shame—Effect of clothing—Evil consequences of modesty—Condition of women—Biological effects—Woman's anomalous menstruation the result of male sexual selection—Sociological effects—Sexuo-social inequalities—Inequality of dress—Inequality of duties—Inequality of education—Inequality of rights—Genesis of the sexuo-social inequalities—The subjection of women—Male sex not responsible—Attitude of science toward the equalization of woman's condition—Male and female supremacy in the lower forms of life—Assumed superiority of the natural over the artificial—Sexuo-social dynamics—The non-essential social forces—Physical aspects—Subdivisions—Undue prominence popularly given to the non-essential forces—The æsthetic forces—Fine arts that appeal to the eye—Fine arts that appeal to the ear—The moral forces—The love-forces—Parental love—Consanguineal love—Patriotism—Philanthropy—Self-love—Correlatives of the love-forces—The fear-forces—Classification of the fear-forces—Physical fear-forces—Genesis of pain—Physiological explanation of fear—Fear of violence—Fear of man—Fear of animals—Fear of inanimate nature—Fear of spiritual beings—Fear of disease—Psychical fear-forces—Sociological effect of the doctrine of immortality—The intellectual forces—Intellect a directing force—Direct effects of intellectual activity—Concluding remarks—Why the discussion has been confined to the passively dynamic stage of society—Tertiary compared with secondary aggregates—Social integration—Social dissolution—Decline through migration of the *élite*—Decline through dilution—Instability of the social organization.

PRELIMINARY CONSIDERATIONS.

The chapter on Man, just closed, instead of logically carrying forward the series of aggregations of matter and presenting a new phase of the universal process, was really nothing more than the consideration of a special department of Life, in which, however, the ideas embraced in the chapter on Mind were, of course, prominently involved. It might have formed a conclusion to the chapter on Life, as showing the highest degree to which the process of organization has been carried, but its proper treatment would then have been somewhat impeded by a lack of the connection between organization and the psychic phenomena which chiefly elevate man above the rest of the animal world. This alone would perhaps have been sufficient to determine the place in the general system most appropriate for the treatment of this particular case of biological organization; but the title of the present chapter indicates that, independently of such considerations, and whether a proper sequel to a discussion of the phenomena of life or of mind, the inquiry into the true nature of man is a necessary prelude to the treatment of the class of phenomena to which association gives rise, and which are accordingly denominated *social.* If it be true, as Mr. Herbert Spencer insists, that social phenomena represent the resultant of all the activities manifested by the individual social factors, then is it doubly essential that these factors be analyzed, examined, and understood before launching out into the more complicated problems which arise from the repeated compounding and re-compounding of these factors.

Sociogeny a Continuation of the Process of Aggregation.

The phenomena of sociology, unlike those of anthropology, but equally with those of biology and psychology, present us with an additional instance of the great cosmic process of aggregation which we have sought to trace out. Just as the highest chemical aggregates forming the chemical substance protoplasm are compounded and re-compounded in the formation of physiological and then of morphological units, and just as these are further re-compounded to form organic aggregates of the first, second, third, etc., orders, so are the highest of these organic aggregates, or men, compounded anew, on precisely the same principle, to form society. And this is the last and highest step with which we are acquainted of this long, unbroken series of cosmical aggregations leading from the ultimate material atom up to social aggregate.

When treating of man's development, we purposely neglected to dwell upon the influence which this tendency to association exerted upon it. It must be declared at the outset that human association, and hence society itself, is the product of the law of natural selection, or adaptation, and was brought about under the rigid influence of natural economy, which preserves only such things as prove to be advantageous. That there existed in primordial man or his immediate animal ancestors an innate social sentiment which naturally drew any considerable number of men together, is not only improbable *a priori*, but is disproved by the actual condition of the apes, from which family, as we have seen, man has undoubtedly descended. Whether it is to the advantage of any animal to congregate and lead a gregarious life depends, in every instance, upon a variety of circumstances. For all creatures of low psychic development, this will be greatly influenced by the nature, habits, and disposition of the species, and, as a rule, only harmless, noncombative animals are so found. The exception in the case of wolves is doubtless due to their superior sagacity, and the fact that they usually occupy cold, inhospitable countries, where the advantages of association are great and manifest. With regard to the ape-tribes, living, as most of them do, in trees and subsisting chiefly on fruits, it is manifestly most economical to live solitary or in pairs, or at most in troops of limited numbers. This latter is described as the mode of life of some anthropoids, which, having left off their arboreal habits, probably profit somewhat by a semi-gregarious existence. But to increase this degree of sociability would with them soon prove disastrous. Not only would their supply of food early become exhausted, but frequent quarrels would decimate their ranks, and reduce them to the state most in harmony with their mode of life. Not but that these creatures might derive great benefits from extensive association, but their mental development is not sufficiently advanced to enable them to secure, by the least exercise of foresight, any of the advantages thus offered.

This, then, is the essential prerequisite to all true social union, that there shall be sufficient brain-development to enable the individuals interested to perceive, however dimly, the advantages of association. It may be assumed—and this is probably the correct view—that there are two antagonistic tendencies at work both before and after social union has been perfected, the one resulting from certain advantages which such union offers, and from the fact that the natural multiplication of individuals operates to increase the number in any one spot, and the other resulting from the consumption of all the food in such places, and from the fierce contests due to this last cause and various others. The chances in favor of or against the success of such social union will then depend upon the relative strength of these two tendencies. In animals which subsist wholly on vegetables, and which are provided with no special weapons of defense and none of offense, the gregarious habit may soon be acquired. In carnivorous animals this rarely takes place, the anti-social tendencies being constantly uppermost. Up to a certain point, the degree of psychic development probably exerts itself on the anti-social side, since it tends to heighten the sense of individual liberty and of personal possession, thereby increasing the degree of combativeness, without, as yet, producing any realization of the advantages of union for mutual defense or protection. In the case of wolves inhabiting cold climates, and depending to a great extent for their subsistence on the capture of large animals, such as deer, elk, moose, etc., too large for a single wolf to encounter with any hope of success, the advantage of hunting in packs is so obvious that it has been adopted, notwithstanding their combative natures. But it must be remembered that the wolf is the stock from which the domestic dog has sprung, and that it possesses a large share of that high psychic development which is characteristic of those intelligent companions of man, without which it would undoubtedly be impossible for it to adopt gregarious habits.

Conditions favorable to Association in the Simian Ancestors of Man.

Without adducing further examples from other classes of animals, we may consider the effects of these social and anti-social tendencies upon the ape-family, and especially upon the hypothetical ancestral type of the human race. Judging from man as we know him in his developed state, we shall not greatly err in presuming that this ancestral being possessed a very irascible and quarrelsome disposition which must have been increased by the gradual liberation of his fore-limbs from duty as locomotive agents, and their employment in defensive and offensive operations. This anti-social influence, joined with others common to other creatures, must have had the effect to counterbalance the social tendencies of his increased brain-development far beyond the point where the latter would have prevailed in a creature of a more amiable temperament. In fact, these reasons, combined perhaps with the effect of inheriting the solitary or non-social habits of a long line of ancestors, seem to have postponed the adoption of the gregarious or social mode of life until after a considerable degree of cerebral enlargement, the erect posture, and the plantigrade gait had been attained. Even speech may have been rudely acquired while man still roamed about in small troops and knew no arts, not even that of making fire. Races have been found now living and possessing some degree of rude art and an intelligible language, who still scarcely possess anything that can be called society, and seem to live solitary lives or in pairs, the children separating as soon as able to subsist alone.

But it must not be supposed that the history of society has been every-where the same. As the race struggled up from animality to humanity, it broke up into numerous bands which occupied different parts of the world, and were surrounded by different conditions of existence. This no doubt gave rise to great differences in the relative periods at which the social prevailed over the anti-social tendencies. It would seem wholly impossible for a race leading what is understood as a "solitary" life, *i. e.*, a life in which there is the least degree of association consistent with the continuance of the species, ever to acquire the art of speech. Certain calls, calculated to bring the sexes together, might indeed exist and reach some degree of variability, but they could never attain the nature of a language. But, between this state, which is rare among animals generally, and that which amounts to society proper, there are all gradations, and it is in some of these intermediate states that most apes are now found, and that we must presume that the *Pithecanthropi* also lived. The development of the cerebral hemispheres, of speech, and of society, must have gone on simultaneously, each mutually reacting in a favorable manner upon the others. All the other differentiations might have preceded these and been induced by other causes, chiefly by the adoption of the terrestrial habit which was in turn due to the increase of corporeal bulk and weight, rendering arboreal existence impossible, or, at least, not advantageous. But, as even the existing arboreal monkeys are found to possess a larger relative brain-mass than most other animals, it is safe to presume that, at the base of the entire series of special adaptations which raised man to his final place in the scale of organization, lay this *causa causarum* of an antecedent mental superiority, which it was his good fortune to receive in the course of his organic progress from a still lower plane of existence. From the condition of a being such as has been described, walking chiefly erect, with a brain capacity of from sixty to seventy cubic inches, living in troops or rude societies, and communicating ideas mostly by gestures, but constantly accompanied by some chattering jargon in which the different sounds symbolized, to a greater or less extent, emotional states at least, if not true intellectual conceptions —from the condition of such a being to that of certain extremely low races now existing upon the globe, such as the Juángs, the step is indeed short, much shorter than that which spans the interval between the present anthropoid and such a being. And, if it be said that the difference of brain in these cases is very great, it may be replied that it is no greater than that which separates the Australian from the European.

Of the fact that the different tribes and races of men must have advanced at very different rates, no better illustration is needed than is furnished by a comparison of the condition of the existing savages with that of prehistoric man as he is revealed by the remains of his achievements in the paleolithic age. While in these remains themselves we find great differences in the degree of social development, some of them indicating a condition scarcely above the brute, and others a remarkably high degree of engineering skill and intellectual elevation, we also find among living races, exclusive of the truly civilized historic ones, extremes of very nearly the same range. It is a valuable discovery of recent times that, if we would know the history of man's development from the lowest savage state, we have but to study the series of gradations which the various existing races actually present. That the results thus obtained are in the main reliable as indices of the true nature of the development of the advanced races, there now remains little doubt. It is upon this assumption that are based the great works of Tylor, Spencer, and other recent writers, who have suddenly thrown such a flood of light upon the whole problem of society and civilization.

Social Statics and Passive Social Dynamics.—Relying chiefly on the many facts brought forward in these works, and upon the meager teachings of human paleontology, we have thus far sketched the supposed path of the progress of mankind from the animal to the human and the social state, and shall next proceed to develop, in such brief manner as comports with the limits of this work, the principal truths of social statics, and of what we have called passive social dynamics (*supra*, p. 56), or such of them as may be deemed essential to serve as the data of that higher science to which we have assigned the name *Dynamic Sociology.*

The condition, or *status*, of society at the present time or at any past time is the problem of social *statics;* the *natural* progress, or movement, of society, the causes, origin, and genesis of its leading institutions, and the purely spontaneous changes which it has undergone, are problems of *passive*, or *negative*, social *dynamics.*

It is to these two classes of social problems that this chapter must be chiefly confined, as alone affording the data for the consideration of the problem of *active*, or *positive*, social dynamics, of which both the *doctrine* and the *method* will be set forth in the second volume of this work. It is scarcely necessary to repeat that this problem differs from the last-named in contemplating society itself, considered as an intelligent agency, seeking to secure, through the exercise of a true scientific prevision based on a fundamental acquaintance with the laws governing social phenomena, an artificial or teleological control of these phenomena, analogous in all respects to that which science exerts over physical phenomena, in the interest of human advantage and human progress.

Import of the Term Social Science.—Those who are accustomed to speak of a *social science* should contemplate well the meaning which is conveyed by that term.

There is some small danger that this expression may be shorn of its legitimate force in somewhat the same manner as the expression *moral science* has been thus shorn. The latter is now in common use by a class of persons who possess no adequate idea of what science means, and who simply employ the word in deference to a growing public respect for every thing scientific without investing their ideas with a shred of scientific meaning. In their "moral science" treatises they talk of "free moral agency," which is a direct contradiction to the title-page, and clearly proves that the authors have not yet conceived of the most fundamental truth of all science, the absolute dependence of phenomena upon antecedents.

So, with the social science, there are even now those claiming to be its votaries who imagine that it consists of a chaotic mass of incoherent and independent facts of a highly complex order, and that the pursuit and investigation of this science consist of the gathering in and storing away in vast volumes (usually without indexes) of these bewildering details. It is admitted by all without exception that the prosecution of the physical sciences is only possible on the assumption of fixed and unchangeable laws prevailing within each, so absolute in their regularity that the same adjustments are regarded as certain to involve the same results under like conditions. Without this it is admitted that no advance whatever could be made in utilizing the physical forces, no inventions would be possible, and no laws could be established in the physical universe. In short, without this assumption there could absolutely be no science. But science means the same in all departments or it means nothing.

There can no more be a moral science in connection with a free moral agency, or a social science while human events are determined by an arbitrary free-will, whether human or divine, or both, than there could be a physical science in a purely "chance world." If it be really true that these higher departments of phenomena are exempt from the control of invariable law, and subject to the caprice of irresponsible volition, then is it utterly vain to talk of moral or social science, and those who make this claim while at the same time employing these expressions are guilty of the most obvious and glaring inconsistency.

The true sociologist speaks of social science because he firmly believes that social phenomena are under the dominion of unvarying law in precisely the same sense that astronomical phenomena are, while he ascribes the apparent irregularity and non-conformity to our ignorance of the subject due in turn to the far greater complexity in which these events are involved. If he is mistaken, he is at least consistent.

The primary concept upon which all science rests, as already remarked, is the dependence of *phenomena* upon *antecedents*. The phenomena are the *effects* of the antecedents as producing, or efficient, *causes*. The production of an effect by a cause involves the notion of change—movement. It is a dynamic phenomenon. The etymology of the word *dynamic* (δύναμις, power) shows how naturally the human mind connects the idea of *motion* with that of *force*, and it is only in recent years that another word (kinetic, kinematic) has been adopted into mechanics to sever this connection.

The mind can not, however, conceive of a change without referring it to some power adequate to produce it. In the word *effect* there lurks the inseparable idea of motion, while in the word *cause* there equally inheres the idea of force. The further analysis of these terms has been presented in a previous chapter (*supra*, pp. 228, 291), and we may with entire propriety content ourselves here with the more popular proximate expressions.

Analysis of its Forces the Initial Step in establishing a New Science.—We perceive, therefore, that in any department of phenomena the laws, whose establishment gives it the character of a true science, depend upon the operation of certain *forces* prevailing within that department which underlie, or rather constitute, the causes of which the phenomena are the effects. And, although in modern times great progress has been made in the direction of correlating these forces and demonstrating their dependence and their common origin, if not their ultimate unity and identity, still this (to the causal intellect) grand and wholesome result will probably never be carried so far that the subdivision, classification, and separate denomination of these forces will not always, as now, prove convenient and necessary for the practical teaching and prosecution of science. In fact, it is this analytical treatment of the forces of nature, and their subdivision, classification, and naming, as distinct principles of material change, that has brought the world out of the chaos of the earlier ages, and enabled it to proceed with the work of perfecting its knowledge of the material universe. The universe is so vast that it was necessary to attack it in detail. So long as it was attacked in gross, after the manner of the older cosmologists, no impression could be made upon it. But no fears need be entertained from any of the generalizations, such as that of the unity of force, which man has been able to make by a synthesis of the data which have previously been laboriously elicited.

Each science, too, after it has been made to take shape by a careful study of every thing which it presents *sui generis*, must be further analyzed and subdivided into still more limited departments. In physics, for example, we find that, before we can commence the practical study of the physical forces, we must further classify them into barologic, acoustic, radiant (optics, thermology, etc.), magnetic, electric, etc., each of which must be prosecuted separately, however manifest their ultimate correlations or identity may be. It is the same with the rest. Analysis must precede practical investigation. Positive work can only be done on the smallest subdivisions. This analysis, therefore, this penetration into a vast field of however obviously connected phenomena, the staking off and setting apart for detailed consideration of all the departments, groups, and classes which possess sufficient characters of their own to admit of their separate classification—this process is essentially the primary one in the effort to establish a new department of science.

It is considerations such as these that have led me to undertake in this chapter some such an analysis of the social phenomena as experience has shown to be necessary in all the sciences. This endeavor can, of course, take no other form than that of a classification of those influences which are seen to be most potent in the production of social events—a close consideration of the real causes of the facts occurring within the social aggregate. But, as in all other sciences, the causes of phenomena are the *forces* which are operating in each department, and this must be as true of social as of physical phenomena. The real task, then, stripped of circumlocutory explanation, is the classification of the *social forces*, which expression I shall now employ throughout as the only one conveying the technical idea here needed.

Before entering directly upon this classification, a few preliminary remarks upon the nature of society in general will be necessary.

Preliminary Consideration of the Origin and Nature of Society.

Society, in its literal or primary sense, is simply an association of individuals. Animals and birds which are usually found thus associated are termed gregarious. The fact that throughout all historic time man has been found associated has naturally given rise to the general opinion that he is by nature a social being.* And this is doubtless true for man as he is and has been ever since the earliest traditions. But whether he was originally social by nature is quite another

* Auguste Comte, "Philosophie Positive," vol. iv, p. 386; Darwin, "Descent of Man," vol. i, p. 81; Alexander Bain, "Education as a Science," p. 68.

question, and one which, as we have just seen, most probably demands a negative answer.

We saw reason in the last chapter not only for believing that all the present advanced races of men have descended from a lower barbaric and savage state, but that the entire human race may be traced back through a series of differentiations to a state, if not identical, at least equally low, with that of the existing animals.

Assuming man to have once existed in such a state, the mode of life which he must at that time have led becomes the question which first presents itself. It is probable that human nature in its lowest phases has always remained very nearly the same, while in its highest phases it has evidently undergone great changes. There seems to be no doubt that the very attribute which now specifically bears his name, that of *humanity*, did not, in his early infancy, form any part of man's nature. The same may be said of all the so-called virtues—honesty, benevolence, justice, etc. These qualities are the result of his civilization. His moral nature has sprung from his rational faculties, and may be traced back to its origin in *sympathy:* at first confined to his immediate companions or offspring; thence gradually extended to embrace his own clan; then his particular tribe, race, or country; then, to a limited degree, the whole human race; and, lastly, as exhibiting the highest type, and quite rare even among the most civilized, made to comprehend the lower brute creation in one beneficent scheme of morals. Such qualities may very properly be styled derivative, as distinguished from those original ones which must have been common to his animal and his human states of being.

These latter comprehend his physical appetites, and in the mother at least, the love of offspring; that is, they embrace just so much as is necessary for the two great *objects of nature* (*supra*, p. 216)—the *maintenance* and the *perpetuation* of life.

These natural appetites when deprived of gratification give rise to desires, emotions, and passions, and it is upon the frequency and intensity of these, and the physical capacity for doing injury to those who are the objects of them, that the probability or improbability of man's early gregarious or social habits depends. Not to speak of exceptional facts, it is the general law, as already remarked, that animals having feeble passions and few weapons for fighting (which latter circumstance seems again to depend upon the former) are most likely to be gregarious, while those which are easily excitable to rage and possess formidable weapons of attack and destruction are usually found in a solitary state or in pairs.* The mode of obtaining their food often seems to a great extent to determine this, beasts of prey, accustomed as they are to the infliction of pain, being more ferocious than those which derive their subsistence from the vegetable world alone. Another determining cause is the relative degree of sagacity of the creatures, those which possess the keenest mental faculties being more likely not to brook the real or supposed encroachments upon their means of enjoyment. There are many other conditions, such as the abundance or scarcity of food, the nature of the climate and of the surface of the country inhabited, which enter as elements into the determination of the social or solitary habits of animals; but

* Some interesting confirmations of this law, as well as some apparent exceptions to it, are furnished by the vulture tribes of South America, as described by Mr. Darwin, in his "Journal of Researches" (pp. 57–59). He states that the carranchas (*Polyborus Brasiliensis*), though not gregarious, are very sagacious, and assist one another in the capture of prey, and quotes Azara as saying that "five or six together will unite in chase of large birds, even such as herons" (p. 57). Another species of Polyborus (*P. Novæ Zelandiæ*) is said to collect in small groups, "wait at the mouth of a rabbit-hole, and together seize on the animal when it comes out" (p. 58). He further says of this species: "These birds are, moreover, very quarrelsome and passionate; tearing up the grass with their bills from rage. They are not truly gregarious." Of the gallinazo (*Cathartes atratus*), however, which seems to live almost entirely on carrion and to be of a mild disposition, he says, "These vultures certainly may be called gregarious, for they seem to have pleasure in society," etc., which is true also of our Northern turkey-buzzard (*C. aura*).

those above stated are the principal ones, and from them we may make a tolerably safe conjecture as to man's early condition in this respect.

In the first place, he does not appear to have ever been a purely carnivorous animal, but rather an omnivorous one. Yet there are unmistakable evidences that the ancestors of man once possessed tusks or canine teeth clearly designed as weapons of attack. These, however, are secondary sexual characters, and were doubtless used chiefly against those of his own kind. Their first exercise was in that fierce rivalry for the possession of females, so common with the lower animals, and women did not cease to constitute the bone of contention until civilization had progressed a long way, as the traditions of the Trojan War over Helen attest. This and other causes kept the race perpetually embroiled, and it has passed into a proverb that man is the worst enemy of man: *homo hominis lupus.* Whenever and wherever his history has been known, he has always been found at war with his own kind, and every page that has been recorded testifies to the continued intensity of his passions and the brutality of his deeds.

Although we now almost always find him associated, yet, as will be shown in a future chapter (vol. ii, pp. 214, 229, 239), this is for purposes of protection, and seems not to have been his condition until after his intellect had become strong enough to appreciate and devise a scheme of protection.

Thus at a certain stage the associative influence of his superior mental powers was neutralized by their anti-social influence. Before the intellectual qualities had become sufficiently developed to comprehend a scheme of government, their whole tendency was to render man a solitary being. This effect was produced in two ways: first, by individuals destroying one another whenever their pursuits conflicted; and, secondly, by inducing a mutual withdrawal, one from another, through fear of receiving injury. In other words, superior sagacity or intelligence was advantageous both in securing the destruction of, and escape from, his enemies; both of which processes tended to segregation, by decimation on the one hand, and voluntary separation on the other.

The former of these processes was at first more effective than the latter, but, as man became more capable of resisting the natural obstacles to existence in more and more remote and different regions, the practice of migration probably increased. There can be no doubt that these considerations went far to diffuse the race over the globe, and may account for many of the curious facts in connection with its wide distribution.

The Four Stages in the Development of Society.

Thus we can hardly escape the conclusion that at one period man must have been as far removed from a social state as it is possible for a species to be and continue the propagation of its kind, leading a life to a great extent solitary, or at least in small groups. This may be regarded as the *first or initial stage* in the genesis of the social aggregate. But his own rapid multiplication was alone sufficient to make this state only temporary, and the influence of high mental qualities preserved him from the fate of other solitary animals, who only retain such a state by a constant process of partial extinction, produced partly by themselves, partly by other species preying upon them, and partly by natural influences. Human sagacity soon rose to a height which rendered the last two of these modes of decimation practically ineffectual. Man became at a very early period "lord of the fowl and the brute," and able to resist climatic and other destroying forces. The thing he then stood most in need of was protection from his own kind.

But rapid multiplication and comparative safety from external dangers rendered the accumulation of individuals in certain localities a physical necessity, notwithstanding their natural inadaptation to a social condition. This may be regarded as the *second stage* of the development of society. It was a society of which the elements were wholly uncongenial—a forced association. In this state the individual was free, but he was utterly insecure. There reigned the utmost liberty and the utmost license. The moral qualities were as yet unborn. The virtues had no existence. Intellect was the servant of selfish passion alone, and all forms of abuse were of constant occurrence.

The paramount necessity for some form of regulation, at first chiefly of the sexual relations, and then of such rude proprietary interests as began to arise, became gradually apparent, and with the growth of more or less definite forms of headship were developed laws relating to marriages, and to a few other acts. This establishment of the first rudimentary elements of government marked the *third stage*, or epoch of social progress.*

There must, of course, have been many of these social centers, or points, to which individual pairs or families had retired when persecuted or threatened, and from which they had expanded by multiplication, forming new, independent societies. Again, if it be true, as many eminent scientific men have insisted,† that the human race has had several

* See Herbert Spencer's closer classification of the actual existing races, "Principles of Sociology," vol. i, pp. 571, 572, 574. My first and second stages are chiefly theoretical, and are scarcely represented in Mr. Spencer's tables, which embrace known tribes only. In the present state of the race, if we believe in evolution at all, we are compelled to deduce the assumed simpler states from the evidence furnished by existing races. Those who deny the legitimacy of this method forget that it is the one now extensively employed by scientific men not only in the next less complex department, that of biology, but in the now well-established science of geology.

† Agassiz, "Diversity of Origin of the Human Races," in the "Christian Examiner," July, 1850; also, "Men and Apes," a lecture delivered in New York, 1874; Carl Vogt, in "Revue Scientifique," 5 mai, 1877, p. 1060.

Arguments for this view are also presented by Humboldt ("Kosmos," vol. i, S. 228) and by Mr. A. R. Wallace ("Contributions to the Theory of Natural origins, each must have had substantially the same general history.

After the lapse of time, owing to the power of man, through his superior intellect, of surmounting most of those natural obstacles which prevent all other species from increasing beyond a certain maximum, these various small scattered communities grew into tribes and nations, and began gradually to encroach upon one another. War was the natural result, and the strifes between independent individuals in the previous state of anarchy seem to have been transferred to these independent communities. The result was the union, either from compulsion or interest, of many of the tribes, and the enlargement of the spheres of social organization. This process is still going on, and will probably be one day extended to embrace all mankind; though diversity of language and national prejudices operate powerfully to postpone that consummation.

Government, so necessary for the prevention of internal war, became the cause of external war, yet the latter was undoubtedly the lesser of the two evils, and will itself disappear, in turn, when all governments shall be consolidated into one. This event, if realized, will form the *fourth stage* of social progress.

These four stages in the inception, development, and progress of social aggregation—viz., 1, the solitary, or autarchic, stage; 2, the constrained aggregate, or anarchic, stage; 3, the national, or politarchic, stage; and 4, the cosmopolitan, or pantarchic, stage — constitute a great cycle within which all the social forces, statical and dynamical, progressive and retrogressive, have operated and must continue to operate.

It will be perceived that the practical view which we are able to take of this field in the existing condition of the race

Selection," Essay No. 9), both of whom, however, incline toward the monophyletic origin of man. See also Sir Charles Lyell, "Principles of Geology," vol. i, p. 64; vol. ii, p. 481.

is confined almost exclusively to the third of these stages. The first stage lies on the very confines of the sub-human epoch represented by the genus of true animals, which Haeckel has called *Pithecanthropus*, and is equally hypothetical with that now extinct genus. A few unconfirmed reports of the discovery of men in a condition which is referable to that stage alone serve to give what practical proof we have of its real existence (*supra*, p. 417). But, whether now actually represented on the globe or not, its reality as an intermediate condition between animality and humanity rests on precisely the same evidence as does the general theory of the development of the race from a lower or sub-human type of existence.

The second stage embodies none of the elements of permanency and can not be expected to be found extensively prevailing at any age of the world. It is essentially a transition stage, and, like transition forms in biology, is characterized by an ephemeral duration. Nevertheless, it has numerous living representatives among the lower existing tribes, particularly among the Fuegians, interior Australians, Wood-Veddas, and Bushmen.

To the third stage, however, as already remarked, belong not only all the savage tribes at all advanced and possessing any settled habits or form of government, but also all barbarians, semi-civilized races, and races and nations calling themselves civilized and enlightened.

If the first stage is a strictly theoretical one, the fourth is a purely ideal one. There is a philosophic ken that professes to see in the future of the race that triumph of humanitarian sentiments, which would no doubt also be a triumph of practical interests, that shall sweep away the present barriers of language, national pride, and natural uncongeniality, and unite all nations in one vast social aggregate with a single political organization.

THE SOCIAL FORCES.

We are now prepared to commence the more special consideration of the nature of the social forces, and to seek, among the varied phenomena to which they give rise, for such distinguishing marks as shall enable us to make a convenient, at least, if not always a strictly logical, classification of them.

All beings which can be said to perform actions do so in obedience to those mental states which are denominated desires. In the absence of desire there will always be absence of what are called voluntary movements. Analyses of the psychological and physiological principles underlying this truth have already been given (*supra*, pp. 392, 397), and will be still further made (vol. ii, p. 321), so that they need not be entered into here. We will therefore rest content to assume that desire is the essential basis of all action, and hence the true *force* in the sentient world; and consistency as well as truth requires us to predicate this equally of man and of all things lower in the scale of animal life.

CLASSIFICATION OF THE SOCIAL FORCES.

The classification of the forces operating in the department of animated nature will then be equivalent to, and, in fact, the same thing as, the classification of animal desires; and, as what is true of all must be true of a part, this will likewise constitute a classification of the social forces.

In the organic world nature may be said to possess two primary objects, viz., the preservation of the individual and the continuance of the species or race. These ends are secured by means of desires inhering in the individuals, leading them to perform the necessary acts. The two *functions* absolutely essential to life are nutrition and reproduction. To these correspond in all sentient beings two classes of desires. These may be denominated the *gustatory* and the *sexual* appetites. By the former, the sustenance necessary for replenishing the tissues is attracted to its proper place in the system; by the latter, the reproductive act is rendered agreeable, without which it would not be performed.

Against these objects of nature may be set the corresponding objects of the organism, or, confining ourselves to the human race, they may be called the objects of man. The end of nature is the preservation and perpetuation of life; that of man is the satisfaction of desire. The former is objective, and constitutes a biologic process; the latter is subjective, and is a moral or sociologic process. Properly understood, these processes possess no natural or necessary relation to each other. It is easy to imagine a person wholly destitute of taste; indeed, such cases are on record. The pleasure derived from the contact of nutritious substances with the tongue and palate is obviously distinct from the benefit which such substances confer upon the system after digestion. Such a person as we have supposed would none the less need food because he had no desire to partake of it. It is still more easy to conceive a total absence of the sexual instinct, and this is a much more common pathological condition found in practice.

Some might be surprised that these desires and their functional results, being so wholly unrelated in themselves, should so universally accompany each other. But, to those who comprehend the law of adaptation, the reason is not far to seek. This apparently "pre-established harmony" has been a primary condition to the development of animal life. The agreeableness of the acts of nutrition and reproduction exists because without it nutrition and reproduction could never have been secured. The existence of these pleasures, as of all other pleasures, and of all pain also, is explained on the theory of selection. It is desire alone that leads to action. Among the lower animals it is the momentary impulse that determines it. Hence the latter, if destitute of these passions, in the gratification of which they preserve their existence and continue their kind, would speedily perish. Those that possessed them to a diminished degree must have fallen behind in the race for life, and only those that possessed them in a high degree can have survived the competition. This alone accounts for their presence in the degree in which we find them.

Even man is wholly dependent upon these purely natural forces to preserve his existence, and, notwithstanding his rational powers, combined with all his science, he would quickly succumb if they were withdrawn. In him both these classes of desires are strong, and constitute the motive, either direct or indirect, to the greater part of all his acts. They are the great original and essential forces of society.

In the most primitive forms of society very little else can actuate it; but in developed society the derivative forms of these original desires become so widely differentiated that it is difficult to trace them to their sources and inconvenient to insist on their identity. The dispersion of the human race into cold climates added other wants to those of mere nutrition, and rendered clothing, shelter, and fire as much objects of desire as food and drink. While the gratification of all desire must be regarded as pleasurable, this need not always be absolute; it may often be relative, and the diminution or prevention of pain is as much a satisfaction of desire as the production of positive pleasure (vol. ii, p. 149). These negative desires must be taken into account, since they are as essential to life as positive ones. They constitute the protective forces of society.

As development goes on in society, and even to a large extent below the social stage, there arise derivative products of the reproductive forces. These are of various kinds and degrees. The sexual desire itself becomes wonderfully expanded in its relations, and comes, in civilized races, to embrace all the manifold phases of love and the romantic sentiment, than which no more powerful forces exist in society. Thus far these forces may, however, be regarded as primary, but there are secondary ones of great importance arising out of the relations which these primary ones entail, most of which, however, will be more properly classed as non-essential. These are, the affections which exist between parents and their offspring, so essential to the protection of the latter; the love of offspring for their parents, also a strong bond in most races; the sentiments which subsist between the members of the same family, as brothers, sisters, and other kindred; and, finally, the general feeling which binds related clans, gentes, etc., together, which is the true original of the still more remotely derivative sentiment of patriotism, the sociological position and nature of which were little understood until ethnographers commenced the scientific study of the lower races.

Besides these essential forces of society, either original or derivative, there are others, chiefly derivative, which may be called *non-essential*, as having no direct connection with the great functions of nutrition and reproduction, but certain of which, in the developed state of mankind, have really become very important.

These are: first, the *æsthetic* sentiments, resting physiologically upon the remaining four senses, as the nutritive function rests upon that of taste; secondly, the *emotional* or *moral* forces, in so far as they can be distinguished from those presiding over reproduction; and, thirdly, the *intellectual* forces, or the sociologic result of those yearnings after normal exercise which the mind soon begins to manifest when lifted above the necessity of concentrating its energies upon the mere supply of bodily wants.

The powerful influence in the direction of culture and refinement which the æsthetic sentiments have exerted need not be insisted upon as a sociological factor.

The emotional forces may perhaps be most conveniently grouped around the dominant sentiments of love (with its opposite, hate) and fear (with its opposite, hope); but the systematic development of this scheme of love-forces and fear-forces must be deferred until later in the chapter.

With regard to the intellectual forces, let it be remarked, once for all, to prevent an erroneous impression which might otherwise be quite naturally formed, that their only basis is the pleasure of intellectual activity, in the effort to attain which they produce their only results, at present quite limited, but destined to increase with intellectual development. They have nothing to do with those transcendent effects which intellect secures in its capacity of guide and director of muscular activity toward the satisfaction of physical desires. As such, mind is no longer a true natural force, but a condition to the production of results by the true social forces.

The following table will exhibit at a glance the classification of the social forces as already sketched:

THE SOCIAL FORCES ARE:	Essential Forces.	Preservative Forces.	Positive, gustatory (seeking pleasure).
			Negative, protective (avoiding pain).
		Reproductive Forces.	Direct. The sexual and amative desires.
			Indirect. Parental and consanguineal affections.
	Non-essential Forces.	Æsthetic Forces.	
		Emotional (moral) Forces.	
		Intellectual Forces.	

It will be observed that each of these groups has a real basis in fact, a physiological existence, and a local seat in a definite portion of the body to which it can be readily referred.

The tongue, palate, and, to some extent, the stomach, are the seats of the physical satisfaction excited by the nutritive act, and this pleasure is wholly disconnected from the function of nutrition, which takes place after these sensations have ceased, in a different part of the body, and constitutes a strictly vegetative process of which the nervous system is wholly unconscious.

The local seat of the procreative satisfaction is still more definite, and, as already remarked, still more widely removed, both in time and location, from the function.

The æsthetic enjoyments reside chiefly in the eye or the ear, though the olfactory sensations contribute somewhat to their general sum, the fragrance of flowers being even more highly prized than their beauty.

With regard to the emotional forces, which poetry has erroneously located in the heart, they are less easy to refer to a physical seat; but any one who will carefully observe such sensations will find that they appear to center in the region of the breast, and, while different emotions doubtless proceed from different nerve-plexuses, their physiological basis is no longer doubted by students of the nervous system.

Finally, the intellectual forces have as their local habitation the interior of the cranium, and modern experiments point to the cortical layers as the probable region of all the higher forms of brain-action.

The sociologic importance of these facts lies in their scientific bearing, as showing that the phenomena manifested by organized beings have definite and tangible properties, such as inhere in other classes of phenomena, and by means of which they may be investigated, comprehended, and controlled by the appliances of art. Like other phenomena, social phenomena flow from definite antecedents, depend upon conditions within the reach of science, and hence may be affected, as physical phenomena are affected, by the intelligent alteration of those antecedent conditions.

But, aside from these corollaries which belong to the applied stage of social science, and will be duly considered at the proper time, it is of the utmost importance to find just what the social forces really consist in, how they are constituted, and where they are physically located, and to be able to distinguish them from other things which have not the character of true forces.

Following this simple yet perfectly rational theory of the science, let us consider, first, the preservative; secondly, the reproductive (these constituting the essential); and thirdly, the various secondary or non-essential forces. Other derivative, or acquired desires will be noticed in connection with the original or natural ones from which they are the outgrowths, developments, or corruptions, and this although they may no longer be preservative, reproductive, or æsthetic. Of the preservative forces I shall not attempt systematically to keep up the distinction between positive and negative, but shall regard the entire subject as a whole in its various philosophical and historical aspects, as bearing upon the social condition of the race.

GENESIS OF SOCIETY THROUGH THE ACTION OF THE SOCIAL FORCES.

The first desire of all creatures is for nourishment. As the babe seeks its mother's breast as soon as it is born, so the human race spent its infancy in the single pursuit of subsistence. In a pure state of nature, where the spontaneous products of the vegetable world supply, unprepared, their only food, there seems, indeed, little else for a being to pursue. In the tropical zone, where man must have made his first appearance, fire and clothing were not required, and shelter was afforded by the trees of the forests. Such was doubtless man's early state, when for ages he roamed over the regions of interior Africa, Southern Asia, Australia, and perhaps Central and South America. But the efforts already alluded to, to break over the territorial limits of the fauna to which he belonged, made necessary by his rapid multiplication and his quarrelsome and unsocial disposition, being in a manner successful in consequence of his superior sagacity, he soon found himself carried into uncongenial climes where nature no longer furnished all the necessities of his existence without preparation or labor in procuring them. Multiplication alone might have brought about the necessity for labor by exhausting all the spontaneous productions without supplying the demands of so many individuals. With other animals under the same circumstances, this excess always perishes from want, between which and the perpetual and fierce struggles of individuals man was forced to resort to migration. That other creatures also resort to migration under similar circumstances is a well-known fact of geographical distribution, but in the attempt they are usually unsuccessful. They succumb to inclement weather and the various other obstacles with which they meet. But man surmounted these obstacles, though, doubtless, only after many failures, and ultimately triumphed over climate and soil, over animate and inanimate foes. If I were to employ a single word which could be made to convey the whole notion of man's supremacy over nature and his superiority over all other living things, I should choose the word *Labor*. His labor of mind, seconded by his labor of body, have made him conqueror of nature and master of the planet.

That which has preserved the human species from extinction and from local circumscription has been the law of natural selection, or the survival of the fittest. This latter term means that those who are best capable of surviving, survive, and not, as some seem to suppose, that those who are most deserving of life, live. It has a physical and not a moral signification. It is not because man was the most worthy to maintain an existence upon this earth, that he has lived when other species have perished. It is because he acquired the power of resisting the influences which swept other species away. The secret of his survival and supremacy lies in his intellectual power. He has exercised this power, the most effective of all forces,* in defeating by *indirection* those attacks which have overcome the *direct* efforts of creatures of far superior strength.

When we recognize the full influence exerted by the normal, or indirect, action of the intellect, and concede to man a considerably higher development of this faculty than is possessed by any other being on the globe, there is no difficulty in accounting on natural principles for his gradual elevation and distribution. And the fact that one being has once gained the ascendency now held by man constitutes in itself a sufficient reason why no other can attain it.† Only one such being can exist at once upon the same planet.‡ Every other creature must perish before his power, or be brought into his personal service. He must multiply. If the globe is to be inhabited, it must be by individuals of his race. The ferocious beast, the venomous serpent, and the noisome insect, must be exterminated as his enemies. The antelope and the grouse must be hunted for his nourishment and his pleasure. The very fishes of the sea and the monsters of the deep must fall a prey to his universal rapine. If it be true that the wildernesses of interior Asia and Africa are developing other lines of superior beings in the *Primates* of those regions, which, were there no human race, would at length supply one to the world, there is no hope that the present dominant being will permit nature to carry out such a scheme. The forces of mind are a thousand-fold more

* To avoid the possible charge of ambiguity, it may be here stated that nothing thus far said or to be said hereafter, respecting the *intellectual force* proper, is intended to deny the mighty influence of normal intellectual action. It is only maintained that this influence is in no way analogous to the remaining social forces, and is not a true natural force capable of management as are the physical forces. In a word, the normal, or indirect, action of the intellect does not obey the universal laws of motion, and it is this which constitutes the only certain test of a truly natural force (vol. ii, p. 95).

† A theory for man's initial supremacy has already been put forward (*supra*, p. 428).

‡ Lyell, "Principles of Geology," vol. ii, p. 487.

rapid than those of matter. The millions of years that it would probably require to transform apes into men, perhaps I may say that it has already once required to perform the same or an equivalent task, would be sufficient for the comparatively lightning-like forces of mind to push their positive civilization into the most impenetrable wildernesses and the most barren deserts, sweep away or subordinate all living species, re-enact in Africa and South America—only in their own peculiar way—the scenes which Asia and Europe have witnessed, and establish a cosmopolitan nationality and a universal civilization.

Nor is it the lower animals alone whose development man checks, and whose existence he threatens. The same process is going on between the superior and inferior races of men as between men and brutes. The development of the lower races is being checked by the higher ones. The latter find the former in their way as much as are the wild beasts. Whether they know it or not, whether they intend it or not, the superior races all over the globe are gradually but surely crowding the inferior ones out of existence. Where to-day are the peoples which the Europeans found both in North and South America?* Read the history of

* An attempt has been recently made to show that the number of Indians in North America is nearly or quite as great as it was at the time of the occupancy of the whites. (See a paper by Brevet Lieutenant-Colonel Garrick Mallery, U. S. A., read before the Anthropological Sub-section of the American Association for the Advancement of Science, at its twenty-sixth meeting, held in Nashville, Tenn., August, 1877, "Proceedings," p. 340.) This, if true, should surprise no one, considering the comparatively gentle treatment which these Indians have received at the hands of the whites, and the earnest efforts made by the United States Government to protect, supply, and civilize them. For, notwithstanding some bad faith on the part of agents under great temptations, this national effort has not only been sincere, but on the whole successful, and it is very doubtful whether these Indians could have held their own better than they have, had no whites ever molested them.

It has been very different in South America and in Mexico, where absorption and amalgamation have been extensive in regions originally populous, while in sparsely settled regions extermination has been nearly complete.

the early settlements of all these countries. The work of extermination and absorption is still going on. In the southern part of South America the aborigine is hunted by the descendants of the Spaniards, and shot down as coolly as is the jaguar.* The same operation has commenced in Africa at several points, and has long been going on in India. Unless the moral forces of civilization rapidly overtake and arrest this work of the natural forces, the whole globe will in a comparatively brief space of time fall under the absolute dominion of a single race. It is, therefore, no wonder that other beings or other races fail to develop, in the slow course of nature, and occupy positions alongside of the present dominant inhabitant of the earth. The reason is clear—because that race refuses to permit it, and has the power to prevent it.

METHOD ADOPTED FOR TREATING THE SUBJECT.

In a future chapter (vol. ii, p. 178), devoted to a review of the primary conditions of human progress, the chief means and the principal institutions of which man has availed himself for the promotion of his interests will be considered. It is not proposed to anticipate this discussion here. It will be more to the point to undertake a somewhat detailed examination of the direct results of the operation of the social forces as above classified, with a view to determining the manner and the degree in which each has respectively contributed to the production of the existing state of society. We shall thus have to consider first the results of the direct operation of the positive forces of individual preservation which is secured by the process of *alimentation*, the sole incentive to the performance of which is the sense of taste, or the gustatory desire, coupled with the gnawings of the stomach, commonly called the pangs of hunger. These pleasurable and painful desires are satisfied by the contact

* Darwin, "Journal of Researches," p. 104.

and appropriation of nutritious substances in the manner suggested by the nature of the organism. Both the substances and the process are appropriately designated by the term *subsistence*, which is employed in both a passive and an active sense. This field, therefore, of the positive forces of preservation is commensurate with the general subject of subsistence, which, consequently, forms the first subject to be treated.

The second natural division of the general scheme embraces the direct effects of the negative or protective forces of preservation, whose objects are twofold, viz.: 1, clothing; and, 2, shelter.

These two classes of desires, constituting the positive and negative forces of individual preservation, may be expressed, where convenient, by the generic word *want*, regarded as a predominant social force.

The reproductive forces, consisting primarily in the sexual instinct, and secondarily in those higher derivative emotions culminating in the constant love of one man for one woman, and *vice versa*, will next come up for consideration, completing the survey of the essential forces.

The non-essential forces will be treated in the order in which they are arranged in the table on page 472, under the three general heads: 1, Æsthetic Sentiments; 2, Physical Emotions; and, 3, Intellectual Yearnings.

With the object of enabling the reader to follow more easily the logical order preserved in this necessarily somewhat prolonged discussion, the following synopsis of the several heads to be treated is introduced, in which the indentations employed will exhibit the relations, co-ordinate and subordinate, of each head more clearly than they can be indicated by their titles as they occur:

TABLE OF HEADS EMPLOYED IN TREATMENT OF THE SOCIAL FORCES.

THE SOCIAL FORCES.

A. The Essential Social Forces.

- *I. The Preservative Forces.*
  - Hunger and Cold (*i. e.*, Want) regarded as Forces.
  - Subsistence.
  - Feeling, not Function, the Object of the Social Forces.
  - Origin of Art.
  - Relation of the Mind-Force to the Sense-Force.
  - Origin of Industry.
  - Property as a Social Factor.
  - Genesis of Avarice.
  - The Law of Acquisition.
    - The Principle of Deception.
    - Natural Justice.
    - Transition from Natural Justice to Civil Justice.
      - Influence of Sympathy.
      - Influence of Increased Intelligence.
      - Influence of Diminished Power to acquire.
    - Genesis of Civil Justice.
    - Modes of Acquisition.
      - Classification of Modes of Acquisition.
      - Producers.
        - Classes of Production.
          - Primary Production.
            - Sources of Food.
              - Mineral Foods.
              - Organic Foods.
              - Nutritive Foods.
              - Respiratory Foods.
              - Vegetation the Original Producer of Organic Foods.
              - Sources of Vegetable Food.
              - Sources of Animal Food.
            - Production of Foods.
              - Production of Mineral Foods.
              - Production of Vegetable Foods.
              - Production of Animal Foods.
          - Secondary Production.
            - Appliances for Protection against Climate.
            - Nature and Sociologic Importance of Invention.
            - Production of Artificial Appliances.

- Art of making Fire.
- Production of Clothing and Shelter.
  - Production of Clothing.
  - Production of Means of Shelter.

Accessories to Production.

- Distribution.
  - Transportation.
  - Exchange.
  - Finance.
  - Distribution as a Mode of Acquisition.

Parasites.

- Classification of the Non-Industrial Modes of Acquisition.
  - War.
  - Government, or Statecraft.
  - Hierarchy, or Priestcraft.
  - Monopoly.
    - Monopoly of Transportation.
    - Monopoly of Exchange.
    - Monopoly of Finance.
    - Monopoly of Labor—Slavery.
    - Monopoly of Manufacture.
    - Remedies for Monopoly.

II. The Reproductive Forces.

- The Sexual Appetite.
  - Anomaly of Woman's Sexual Sentiments.
  - Difference in the Sexual Instincts of Males and Females.
  - Diffusion of the Sexual Instinct.
  - Love.
    - Sociologic Effects of the Love-Sentiment.
      - Physical Modifications.
      - Social Modifications.
        - Male Sexual Selection.
        - Marriage.
          - Principal Forms of Marriage.
            - Polygyny.
            - Polyandry.
            - Monogamy.
        - Genesis of Modesty.
        - Condition of Women.
          - Biological Effects.
          - Sociological Effects.
            - Sexuo-Social Inequalities.
              - Inequality of Dress.
              - Inequality of Duties.
              - Inequality of Education.

A. THE ESSENTIAL SOCIAL FORCES.

Those forces upon which the existence of society and of man himself depends are properly designated as essential forces. They are those which lead respectively to the preservation and the perpetuation of human life, and are named accordingly the preservative and the reproductive forces of society.

From the purely biological point of view, the term *nutritive* would have been logically preferable to the term *preservative* for the first of these classes of forces, but the reader will perceive as he proceeds that for the broader needs of the sociologist the former term would prove inadequate.

I. The Preservative Forces.

The history of the preservative forces is comparatively unimportant in the pre-social state. As a biological factor, nutrition, of course, stands first, and in the struggle for existence is the primary cause of morphological modification. This phase has already been sufficiently treated in the preceding chapter. But, as a sociologic factor, as a motive to action in the sub-human stage, considered in relation to the genesis of society, the pursuit of subsistence wrought no profound alteration in the character of the immediate predecessors of the human race.

Operation in the Pre-social State.—Whatever may have been the mode of life of the true *Pithecanthropi*, their efforts to secure the necessary supply of food could have exerted upon their habits and their physical development little more than those silent and secular influences which are taking place throughout the animal world, and even among plants, in obedience to the same law.

Become a Factor with the Recognition of Property.—But with the earliest forms of association there is usually developed some vague conception of proprietary rights. The genesis of this conception is peculiar, and a large body of facts combine to show that the idea of property was a social before it became an individual sentiment. The first notions of property seem to have been communal, and the distinction between owners was at first that which assigned it to one tribe or gens rather than to another. Mingled with this custom of ownership in common there is, nevertheless, sometimes found among the lower races a remarkably definite conception of individual ownership, extending it even to children.

The conceptions of property among existing uncivilized races vary greatly, and any attempt to describe them would lead us much beyond the very restricted limits imposed by the scope of this work. The fact which chiefly concerns us is, that in civilized society we find a wide-spread system of proprietary rights and customs to be genetically accounted for, and this genesis is the special task before us. The problem is to show that the normal operation of the preservative forces in the social aggregate would naturally evolve a system similar to or identical with the one we know to exist. This problem involves a somewhat fundamental treatment of the philosophy of these preservative forces, and a more accurate classification of their subdivisions.

Hunger and Cold (*i. e.*, *Want*) *regarded as Forces.*—The fact that all social forces consist in bodily desires must be kept constantly before the mind. These, as we saw, are sometimes relative, and are divisible into two general classes, positive and negative, the former seeking the active preservation, the latter merely securing the protection of life.

Classifying again on the basis of the consequences which flow from the non-satisfaction of these desires, we perceive that all those of the positive group cluster round one painful bodily state which may be generically denominated *hunger*. All those, on the other hand, belonging to the negative group may, in like manner, be conceived as clustering around another painful bodily state which may be generically denominated *cold*.

Generalizing yet again, we may contemplate the effect of both these painful bodily states, and designate this compound state by the term *want*.

Since, therefore, all desires are in the nature of painful bodily states, whose struggles to pass over into the correlative pleasurable ones result in the powerful discharges of nervous energy which constitute the *forces* under consideration, there is nothing misleading in the proposal to designate the positive social forces by the name *hunger*, and the negative ones by the name *cold*, or generally to embrace the preservative social forces under the single appellation *want*.

Subsistence.—The subjective term *want* has as its correlative the objective term *subsistence.* To obtain the latter is to satisfy the former. The satisfaction of want through the procurement of subsistence is not accomplished without effort involving muscular exertion. The great variety of wants of both the positive and the negative classes demands a corresponding variety in the forms of individual activity. It is this incessant activity in the supply of constantly renewed wants and in the pursuit of the manifold kinds of subsistence that accomplishes those results upon the surface of the globe which constitute civilization. Spurred on by hunger and cold, with their train of concomitant and derivative forms of desire, man has hunted the wild beast, domesticated the useful animals, cultivated the soil, cleared the forests, worked the mines, fabricated an endless variety of useful articles, and transported the products of this labor over sea and land, distributing the wealth of the world.

Feeling, not Function, the Object of the Social Forces.—The salient fact which it behooves us specially to notice is, that these results are the *indirect* products of the social forces, and have no relation to the real object sought by the agents who accomplish them. This latter object is simply the temporary satisfaction of an immediate physical demand, and the advancement of civilization or social well-being is never for a moment contemplated. It is this which stamps all human progress, thus far accomplished, with its passive character, and it is upon this characteristic, as contrasted with the idea of a conscious effort on the part of society to bring about an improved social state foreseen and planned by society, that is based the subdivision of social dynamics into the two classes, passive and active, as set forth in the INTRODUCTION (p. 56).

ORIGIN OF ART.

Considering the existing industrial races of men, we are compelled to assume that they have passed into their present from some pre-industrial state. The precise line which marks this transition can not be accurately drawn, but the necessity for labor by one sex or the other, or both, exists in nearly all savages, even excluding the chase from the industrial occupations, which in strictness should not be done, so long as it constitutes a primary source of subsistence. In general it is the accumulation of many individuals on a restricted area which chiefly necessitates the resort to labor for subsistence. We have seen that this must take place with every living creature, but that with the lower animals increase is checked by competition, and dense aggregation prevented by attempts at migration, most of which are unsuccessful. The only possible escape from these consequences, except perhaps temporarily by war and plunder, is productive labor. Unless the human species remain permanently thus restricted or perish entirely, Nature must be compelled to increase her normal yield of subsistence. The superior intelligence of man, after long and costly experience, at last succeeded in thus subjugating nature. The means employed was *art.* Whether it be in the manufacture of rude weapons wherewith to slay the antelope, in the reduction of the wild sheep and ox to a state of domestication and servitude, in the fashioning of implements for the tillage of the soil, in the manufacture of clothing out of skins, wool, flax, and other fibers, in the construction of thatched huts for protection from the weather, or in the use of flint and tinder for building fires, without which processes the range and numbers must be restricted as they are in other species—in any case it is clear that the true social forces must have been guided and restrained by the intellectual power foreseeing good and evil consequences, securing the one and avoiding the other.

Relation of the Mind-Force to the Sense-Force.—In partial anticipation of a fuller discussion of the subject in a future chapter (vol. ii, p. 99), it may be here remarked that the relation which the mind-force bears to these sense-forces is similar to that which the rudder operated by the pilot bears to the sails operated by the wind. Desire uninfluenced by intelligence is a true natural force and obeys the universal laws of dynamics. Bodies acted upon by a normal force always tend to move in straight lines either from the impelling or toward the attracting body. If they move in curves or irregular lines, it is because a plurality of forces, having different directions, are operating upon them. It is precisely so with organisms impelled by desires only. They move as directly toward the objects of desire as do the objects of magnetic attraction toward the attracting magnets, or falling bodies toward the earth's center. This truth is expressed by the adage that "love is blind." Appetite also is blind; all desires are blind. The social forces are all blind forces. They impel to direct action toward the objects of desire.* If obstacles intervene, they are simply arrested, and never attain these objects. They are well illustrated by the familiar case of the fly buzzing against the transparent pane until exhausted, without sufficient intelligence to go above the sash where no glass intercepts. The American partridge (*Ortyx Virginiana*) is caught in great numbers by attaching kernels of corn to the end of strings tied to a stake. The bird swallows the corn as far as its crop, and, in attempting to go away, invariably turns its head away from the stake, and does not possess sufficient intelligence to turn around. The friction of the string in the angle of its beak renders it impossible thus to extract the kernel, and the bird is effectually trapped. *Quæ ipse miserrima vidi.* The *mistakes* which men make in attempting to secure the objects of their desires are mostly of the nature of those of the fly and the partridge. There is a disproportion between the strength of the desires and the strength of the intellect. With the lower animals

* The Duke of Argyll seems to have caught a glimpse of this principle in the following passage: "The conscious energies of the will are ever tempted to march directly upon objects which can only be reached by circuitous methods of approach" ("Reign of Law," p. 341). (See INTRODUCTION, *supra*, p. 71, note.)

in their ordinary habitats this disproportion is removed by gradual adaptation. Their activities go on within the sphere of their intelligence. There is a correspondence between the organism and the environment. But remove them from their natural habitat, and this correspondence is more or less completely destroyed. Even within their natural range of activity this correspondence is never absolutely complete. Moreover, the higher the degree of organization, the greater the lack of adaptation. With the human race, while the degree of corrrespondence is always sufficient to enable it to subsist, there are constantly felt innumerable jars, discords, and inadaptations.

ORIGIN OF INDUSTRY.

For innumerable ages the chief object of human activity must have been subsistence. Indeed, it is the chief object of the life of all lower creatures and of the majority of all human beings to-day. The first question which every living being must settle is, How shall I obtain a subsistence? this being identical with the question, How shall I preserve my existence? Self-preservation is said to be the first law of nature. This proverb is as true of a being, when attacked by hunger or the elements, as when attacked by another being. It is a *law* of nature because it is the legitimate effect of the operation of the primary forces of animated nature, the preservative forces, and the regular effects of forces are laws. It is a law of *nature* because these forces are nature's forces, as much as are those of gravitation, electricity, or chemical affinity. No power can destroy them. The particular results which they seek to accomplish may be defeated by obstacles, but the force is not destroyed. Even intelligence can only direct these forces, it can never increase or diminish them. They are perpetually at work, inspiring activity and impelling muscular movements in the direction of procuring subsistence.

This activity, when directed by the intellectual forces to the increase of natural production, or in constraining nature to yield a larger supply of subsistence than it yields spontaneously, assumes the form and takes the name of *labor*. The first lesson, therefore, which man had to learn, as his numbers became too great for nature to supply his wants, or as he wandered away from the spot which originally supplied them without effort, was, that he must labor.

No amount of sagacity or cunning, no increased brain-development or heightened intellectual powers, sufficed to remove this necessity. It was a glorious achievement of mind when it first taught him how, even by means of labor, to compel Nature to multiply her original supply for his sake. Beyond this it could not go. It could not by any act of sagacity or foresight create the material substance necessary to nourish the body. Mind can only act upon matter through the medium of other matter in a state of organization. Only by means of hands and feet, propelled by muscles which are under the control of nerves and brain, can the last-named organ secure the fruits of its designs. It is true that in later times mind has secured subsistence for many bodies without labor, but for every such idle body there has been one doubly tasked. It is also true that, by the invention of machinery, mind has vastly reduced the quantity of manual labor necessary to supply one body, but this has consisted simply in the substitution of mechanical for muscular energy.

Nearly every thing that is capable of nourishing the animal body must first be organized through the vegetable economy. The soil, therefore, from which, practically speaking, all vegetables must spring, is the true original source of animal subsistence. The consumption of animal food is simply the re-appropriation by the system of organic matter already once appropriated from vegetables by the animals consumed (*supra*, p. 350). There is much evidence that man in pre-industrial times was a strict vegetarian, and that his present almost omnivorous habits have been the result of the vicissitudes and the necessities incident to his wholly anomalous career as compared with other species.

Confining ourselves strictly to his industrial state, whether as a hunter, a shepherd, or a tiller of the soil, we see that man must have constantly and arduously pursued this one object, subsistence. The hunting state was least conducive to progress, since it tended to develop the muscular at the expense of the nervous powers, to render the body vigorous, blunt the sensibilities, and cause neglect of the intellect. Still it must have increased the power of certain mental forces, cunning in circumventing the animals which he sought to destroy, and courage in battling for the possession of the objects of his desire. The pastoral state fostered both revery and observation. Many of the most beautiful products of the human imagination, as well as of the most valuable facts of science, have emanated from shepherds as they have idly watched their flocks. The agricultural state was, on the whole, best calculated to develop the progressive powers of the race, since, while it stimulated energy and thought, it did not dull the feelings. The variety of labors and of utensils required, and the practical sagacity demanded for the profitable economy of seed, harvesting of crops, and observation of the weather and the seasons, together with the extensive margin which always existed for improvement and perfection in all its departments, rendered the georgic far superior to both the bucolic and the venary modes of obtaining subsistence. Each of them, however, as will be readily seen, is an advance upon the spontaneous method pursued by animals. Each requires an exercise of genius, a certain amount of calculation and invention which marks it distinctly as a *human* enterprise. Each requires art and labor, and compels nature to yield an artificial product. The act of a lion, when he pursues, seizes, and devours an antelope, is not identical with that of man when he performs the same act. The former displays sagacity as well as the latter, but it is instinctive, not rational; it is hereditary reason, if instinct can be so defined, and not such as can adapt itself to each particular case. So, too, both have the necessary weapons, but those of the former are the works of nature, while those of the latter are the works of art. The former owe their existence to the laws of selection, the latter to human design; the former are the products of circumstances without thought or intelligence, the latter of a teleological plan. Again, we must distinguish between the parasitical method, by which certain animals subsist upon the nourishment assimilated by others, and the pastoral life of man, since, in the latter, art and labor, sagacity and foresight, are exercised in the domestication and care of animals as well as in the manufacture of various articles out of the raw products yielded by them. Still broader is the distinction between the means which the agriculturist employs for deriving an increased product from the soil and that which the granivorous and herbivorous birds and animals adopt in subsisting upon its spontaneous vegetation. These characteristics are amply sufficient to differentiate the human from the animal mode of subsistence, and to give a special meaning to the term *labor*. No animal, except under the dominion of man, not even the bee or the ant, can be said, in this proper sense of the term, to work for its living.

In the absence of any system of government, the product of art and labor would, of course, inure directly to the producer. It was required for the immediate sustenance of the individual. As the eagle devours its prey as soon as it has seized it; as the vampire swallows the blood of its victim as fast as it sucks it up; as the cattle and sheep and the birds feed only themselves from the grass and berries which nature provides—so man may be supposed, theoretically at least, to have passed through a stage of development identical with that of these creatures, except in the element of labor, which rendered subsistence an artificial product instead of a spontaneous growth, but which each producer appropriated as fast as he produced it. This mainly theoretical stage was succeeded by another, marking another progressive era, and bringing man another step forward in his social career. The distinguishing feature of this new stage was the recognition of the idea of permanent ownership or *possession*, and hence it may be styled the proprietary stage of civilization.

In order to enjoy an object it must be brought within the scope of the perceptive faculties, within reach of some one or more of the senses. In all the immediate objects of alimentary subsistence their enjoyment is their destruction. The momentary possession of such objects until they are consumed must exist even in the lowest forms of life. It is not, therefore, this which is here meant. The source and the means of these objects are usually more or less durable and stationary, and it is these which have been the real objects of possession. It is clear that this could only apply to a more or less artificial condition of life. It would be unnecessary in a purely natural state. The objects whose source can become a proper subject of ownership must be the results of a greater or less amount of labor; they must be products of human skill. The milk, flesh, and skins of domesticated animals come within this definition; the fruits of the earth are among its best exemplifications. In the former case, the domestic animal becomes a proper subject of possession. It has become so through human skill and labor. In the latter case, the soil itself naturally becomes a subject of permanent ownership, but only after it has been subdued by human industry, and rendered more fruitful than it was by nature. The least amount of labor, however, if it were no more than the mere selection, would be sufficient to constitute a claim.

The recognition of permanent property gave to man an object to pursue, an incentive to industry beyond the mere present demands of his nature. It substituted a future for a present enjoyment. Instead of consuming his product as fast as produced, he felt that in producing much more he could enjoy it at another time. It also begat exchange. The surplus of production over consumption of any one article could be converted by exchange into other articles whereby more desires could be gratified, more enjoyment obtained. The inducements to production became unlimited. He could not produce too much. He could not be too industrious. It stimulated inventive art. For it was not the amount of labor performed but the amount of value produced that was desirable, and, if an implement could be made which would double the product with the same labor, the means of enjoyment would be doubled. It gave a new impetus to human progress. Hitherto it had been external influences that had gradually forced upon man the conditions necessary to progression. Thus far it had been a struggle for life which had exercised the mental and physical faculties, and aroused them to activity. Now, a new force from within joins in the effort. Now commences a struggle for possession as a means to higher and prospective happiness. A thousand new desires spring up as the new and varied objects of skill and labor multiply. Taste becomes refined. The raw and coarse pabulum, which had so long sustained life, is no longer endurable. It must now be *prepared;* labor and skill must be laid out upon it, and it is worked up into a variety of delicate dishes. Habitations are constructed in a more and more complicated manner, and rendered more commodious. Garments are improved both in quality and variety. In proportion as these desires are gratified, the higher pleasures of the eye, the ear, and the brain are sought and secured.

Property as a Social Factor.—The vast importance of property as a means to happiness was little by little appreciated, till at length it became recognized that, in so far as a proper use is made of it, the one is a measure of the other. Pleasure is derived from contact with objects. Its intensity depends upon the variety and adaptation of those objects. Although many of the objects of enjoyment are not themselves the direct subjects of possession, are not themselves property, yet even these are, in some indirect manner, rendered attainable and valuable by means of the property with which they are associated. The history of man and the daily observation of every one tell us experimentally that possession and enjoyment are, in the nature of things, bound up together. The measure of value in objects is the degree to which they can contribute to human happiness. Property is value possessed. Wealth is the term applied to the aggregate of property possessed by individuals or nations. When we remember the struggles which men have been obliged to make to preserve their existence, the ceaseless effort, care, and anxiety required to supply, from day to day, the rapidly wasting tissues, and protect the frame from cold, moisture, and winds, supposing them to consume the needed objects as soon as they obtain them, as do most animals, it requires no special effort of the imagination to comprehend the immense advantage that must arise from the accumulation in advance of a sufficient quantity of property to render, if not labor, at least care and the fear of destitution and suffering, unnecessary. We can then readily understand the cause of man's eager and almost frantic pursuit of wealth. When we come to recognize that the pursuit of wealth is only the pursuit of happiness, a great part of the wonder which is apt to be evinced at the wide-spread and all-absorbing character of this pursuit is removed. Wealth means safety, ease, the fulfillment of desire. It means happiness.

The adoption of a system of exchange made the possession of value of any kind equivalent to the possession of the objects of personal desire. Money, whose use was at length found out, came to stand as a synonym for everything that any one could wish. What wonder that it should be sought, and with an enthusiasm that borders on fanaticism! Man enjoys only that which he comes more or less directly in sensible contact with. Nothing benefits him unless he can either feel, see, hear, taste, or smell it. The more of these senses it can gratify, the more valuable it is to him. But, as a rule, an object is capable of thus imparting its qualities in proportion as it is placed under the control of the individual enjoying it. That is, a thing is worth more to any one in proportion as he is the more absolute owner of it. Therefore, every body wants to own as many such objects as possible, or, what becomes equivalent to this, as much money as possible. Hence the strife to obtain money, to amass wealth.

GENESIS OF AVARICE.

Thus Avarice, a wholly derivative sentiment, has come, and naturally too, to be one of the ruling passions. It is a part of human history, reaching far back into that obscure period when man began to emerge from the animal state, when he was casting about for a means of escaping that otherwise inevitable fate which always has attended and must attend all rapidly multiplying species of living creatures.

But it is not merely as a means of self-preservation that the idea of permanent possession has proved a benefactor to man. It has aroused his faculties. It has not only given him life, it has given him intelligence. Property could only be acquired through industry directed by intelligence. Those who possessed the most tact and showed the most enterprise acquired the most, had the largest number of desires satisfied, enjoyed most. Here arose a grand competition, the natural effect of which could only be to sharpen the wits and stimulate enterprise. Art and labor rose rapidly and assumed form and character. Production increased in a still more rapid ratio. Food, clothing, and shelter were placed within the reach of all who would work and could work skillfully. Conveniences and luxuries followed necessities. Weapons for the chase and for war were invented, pottery and various cooking-utensils were wrought for the preparation of food, agricultural implements were devised, vehicles for travel and transportation were constructed, roads were opened and bridges built, boats were made and launched upon the waters, commerce and trade began. Plenty begat leisure, leisure observation, and observation reflection. Philosophy, history, fine art, and science took root. New desires arose, demanding new objects, and these in turn were supplied by the exercise of still higher activities.

The conception of permanent possession is what gave to civilization its initial impulse. Industry, inventive art, and skilled labor are each sustained by this vitalizing sentiment, so commonly misunderstood and so frequently condemned. Since to preserve life, to avert evil, and to secure happiness, have always constituted the primary motives to human action, whatever had these ends in view has naturally acquired the name of practical. The phrase "means of subsistence," used in its widest sense, may be taken to embody this class of objects. When the idea of permanent possession became developed, and the possibility of accumulating these objects for future consumption was recognized, all limitation of the quantity of value, which it was desirable or useful to amass, except in the case of things immediately perishable, was removed, and men were seized with a desire to reduce as many of these valuable objects as possible to possession, in order to provide against unforeseen contingencies. The introduction of a permanent standard, or measure, of value, at all times convertible into the commodities needed, extended this principle to the hitherto excluded class of perishables, and brought everything under one general law. The immediate object was thenceforth money. With it any other object, whether perishable or imperishable, could be obtained. Since the greater part of all the objects most indispensable as means of subsistence come under the former class, it is evident that the principle of permanent possession could only have had a very imperfect application before the adoption of a medium of exchange. With its adoption it came forward in full force, and began, from that epoch, its important career.

The Law of Acquisition.

The development of the idea of permanent possession and the adoption of a circulating medium, which were on the whole so beneficial to man, were, nevertheless, attended with some serious abuses. The key to their explanation lies in the fundamental fact that the sole object of human effort was *to acquire*. No such consideration as justice originally found place there. Only one quality was attached to the mode of acquisition, and that was *success*. The grand rivalry was for the object, not the method; for the end regardless of the means. Those qualities both of body and mind best adapted to acquire wealth were those most valuable, most practical, and soon recognized as most respectable and most honorable. There could be but one result. Those individuals in whom these qualities were most highly developed acquired most. While the wants of each were the same, and the supply none too great, it must needs have been that the large acquisitions of this class were made at the expense of those less fortunate in the possession of these acquisitive powers. The chief object was to get; both the manner and the source of the getting were ignored. The force of this may be increased by the antithesis between *getting* and *producing*. If the same wild passion which has so long raged for the acquisition of wealth were directed toward its production, the average production would doubtless be three or four times the average consumption instead of a trifle above it, as is now the case. There might, for example, probably be produced an excess of four or five dollars *per capita per diem* instead of about ten cents.* But the idea of creating

* According to the United States census, the true value of the property, real and personal, in the United States was, in 1870, $30,068,518,507; in 1860, $16,159,616,068, making an increase in ten years of $13,908,902,439. The population of the United States in 1870 was 38,558,371; and in 1860 it was 31,443,321. The average population during the decade, therefore, was 35,000,-846. These figures will show an average annual excess of production over consumption of $39.74 *per capita*, or an average daily excess of $0.10888. The

value formed only an incidental part of the general struggle for getting possession of it.

It is true, somebody must create it. The spontaneous supply of nature was exhausted long before the idea of property, in the sense here used, had occurred to mankind. If we look about us to-day, we find that nearly all wealth is artificial or created. Everything we own has a value acquired in some way or other. All things worth possessing are the products, to a greater or less extent, of labor. There are a few apparent exceptions, but they are confined to such things as are incapable either of permanent possession or of representation by any medium, of which the air is an example. Water generally belongs to this class, though not always. The soil has long since passed out of this category, at least in populous countries. These exceptions made, the rule is universal in civilized countries that all wealth is the result of production. The range and number of the exceptions were not very much increased at the period when men first adopted a medium of exchange. Hence, as remarked above, the wealth which existed had all been produced, and the production was still going on to supply consumption and also to enable certain ones to accumulate large possessions. All were alike endued with a zeal for accumulation, but they did not at all distinguish between the various *modes of acquisition* (*infra*, p. 524). Those who acquired by producing were not actuated by any conception of the superior importance of their method. Could they have gained more by striving after wealth already produced, no one would have hesitated to abandon production and engage in traffic.

Those engaged in appropriating the products of other men's labor never entertained the least idea that their business was less honorable or less useful than that of the pro-

figures for the preceding decade give a daily excess of \$0.09052, making the daily excess for the twenty years \$0.0997, or about ten cents. The as yet untabulated wealth statistics for the decade 1870–'80 indicate a much smaller excess of production, or between six and seven cents *per capita per diem*.

ducer. Neither class had any conception of these economic laws, and each individual limited himself solely to the one idea of appropriating to himself. Neither is there any thing so base and sordid in this as some pseudo-moralists might claim. Man was obeying the same law that every other living creature obeys by the constitution of its nature—the law of self-protection. To secure enjoyment and avert evil, are the mainsprings of all animate activity, and these were the motives which governed men in their earliest economic schemes.*

It is true that this describes not only man's early struggles for subsistence, but his present character and condition. The unphilosophic observer of the economic facts of to-day is filled with disgust and indignation at the false and pernicious mania for getting possession of the wealth already produced. He has no patience with the man who will labor as hard, and scheme as adroitly, and worry out his whole life as anxiously, to draw the property that other men have created into the eddy of his powerful avarice, as would have been necessary to produce it. He finds no words of condemnation strong enough to characterize the millionaire or the miser, the speculator or the stock-jobber. He forgets that all these are obeying this same biological law, uninfluenced by rational thought and unaided by any knowledge of economic principles.

Mr. Herbert Spencer points out the fact that "the dishonesty implied in the adulterations of tradesmen and manufacturers, in fraudulent bankruptcies, in bubble companies in cooking of railway accounts and financial prospectuses, differs only in form and not in amount from the dishonesty

* We saw in Chapter IV that the true producers in the economy of organization are protists and plants, and that all animals are in this respect parasites. In the facts here considered, the appropriation by certain individuals of the wealth created by others is simply a repetition in the tertiary aggregate of the process employed in the secondary aggregate. We have also seen, however, in the Introduction, that it is the prerogative and the duty of man, by the exercise of a teleological direction over the laws of nature, to prevent the normal process, if possible, wherever it conflicts with his interest and advantage.

of the uneducated." * This statement is made with a view to proving that education has little or no immediate effect upon character (vol. ii, pp. 597, 605). Without discussing this question here, the undeniable facts are far more potent in supporting the principle here stated that this "dishonesty," as we call it, is only the natural result of the law which impels all men to the acquisition of wealth, to the accumulation of the means of subsistence. It is only a higher manifestation of the law which directs the savage to decoy and ensnare his game. His object is to secure the means of subsistence. To succeed, he must deceive. He never conceives of any immorality in this. But here, it may be urged, is where the distinction lies, for, we are told, the dishonest dealer does conceive of an immoral quality in his act. This objection will be considered presently. It need only be remarked here that no line of demarkation, satisfactory to all persons, and applicable to all cases, can be drawn between the honorable and the dishonorable. The manufacturer and the dealer excuse their deception in a manner perfectly satisfactory to themselves. If objective justification is wanting, it is easily compensated for by subjective justification. Among the most common of these subjective justifications are these: "I must live," "my family must be provided for," "the world owes me a living." Of course, I will not be misunderstood as claiming that these are valid justifications for dishonesty. I only claim that they are satisfactory to the parties making them. While even the noble maxim that "honesty is the best policy" should be cautiously accepted as universally true (vol. ii, p. 143), every act which society calls dishonest is justified either on objective or subjective grounds by the one who performs it at the time performed. The proper way to prevent dishonesty is to show conclusively in the case of every action that directly or indirectly, immediately or remotely, physically or mentally,

* "Study of Sociology," p. 121, New York, 1880.

it will bring to the performer more pain or less pleasure than its non-performance.

DECEPTION THE NORMAL FORM OF INTELLECTUAL ACTION.

The law of acquisition above stated, which is biological as well as sociological, since it is the law alike of man and of the lower animals, and is carried out by the psychic forces which include the social forces, is supplemented in the human race by another law, which may be called the *principle of deception.*

This law arises with the development of the intellectual faculty, and, properly viewed, it constitutes the essential form in which that faculty every-where manifests itself, although this truth is masked by the great variety existing among the objects toward which intellectual operations are directed.

To make this generalization more clear, it may be said that it is by a sort of deception that man obtains every thing. It is a deception to catch and domesticate an animal. It is a deception to ensnare one. Yet these are the necessary means of reaching the pastoral or the hunting state. And is it not a sort of deception to wring a surplus product from the soil? Is it not a species of fraud to contrive a mechanical apparatus, to take advantage of nature's forces and enslave them? If we deny this use of the term, it is solely because we do not conceive of the vegetable or mineral world as possessing feeling. In this respect we are probably principally right. Yet the caution with which such arts have been employed shows conclusively that all these modes of cheating and defrauding nature have been regarded as dangerous. This caution has never been exemplified better in the case of animate than of inanimate things. It is true that it arose from fear of personal danger from offended deities. The true morality of sympathy is a very recent development. The great error which is so continually made in considering such questions is that of assuming the same keen sense of sympathetic justice in those we are contemplating which we ourselves feel.

Sagacity, cunning, genius, all necessarily imply deception, and constitute a sort of *vulpinism*. Every victory over nature, whether in its sentient or insentient department, involves the principle of deception which is seen displayed in all forms of strategy, craft, or cunning—viz., an indirect method of procedure (vol. ii, p. 99). The normal operations of the intellect, as distinguished from those of the emotions, and whereby it accomplishes so much greater results, are essentially of this character, so that it may be said that *invention is deception*. By it the forces of nature are ensnared and circumvented. Language itself enforces this truth. The methods of art are *artifices*, and its mode of procedure is *artful*. Machines are *machinations*. Primitive man had early to learn that to live he must deceive, and, although this principle has never found expression in any code of ethics, it has found unceasing application throughout history. The sociologist can no more ignore it than he can ignore other fundamental laws. Political economists have failed to recognize this principle, or have not dared to admit it, through fear of seeming to inculcate it. This has rendered much of their reasoning unsound.

Those who employ the vituperative method, and have the habit of denouncing the deceptions practiced by men, should learn a lesson from animals to which they would probably deny a moral faculty. They will there find not only the cunning of the serpent, the slyness of the fox, the stealth of the lion, and the treachery of the hyena, but they will find that there exists every-where a merciless competition in these arts by means of which the more sagacious and powerful are perpetually circumventing and destroying the more simple and feeble. It has been previously pointed out (*supra*, p. 32) that, whatever human ideas may prevail, the law of nature is the "right of might." But the normal influence of the intellect, the schemes, contrivances, wiles, and deceptions which are the marks of sagacity and even of intelligence, can not be omitted from this notion of "might," since, when fully understood, they show themselves as the mightiest of all agencies.

NATURAL JUSTICE, OR THE LAW OF FORCE.

The law of force thus stated is an essential part of the law of acquisition, and inheres in the psychic process. Its method may be denominated *natural justice*, as distinguished from the popular conception of justice, which we may call civil justice.

Under the normal operation of the psychic and social forces, the weaker yield to the stronger as certainly as that in physics motion will take place in the direction in which the stronger force acts. In fact, were this of sufficient consequence, it could be shown that the acts of individuals represent the resultants of different forces according to the strict laws of the composition of forces (vol. ii, pp. 320, 335). We thus possess a science of *social mechanics*, which is destined to receive adequate treatment so soon as sociology shall have been universally admitted into the family of sciences.*

These dynamic phenomena, as seen in the animal kingdom, whereby large groups exist only by the destruction of other animals, are paralleled in human operations: first, by the slaughter of animals for food; and, secondly, by the greater or less destruction of the inferior races by the superior ones. Again, the universal competition going on throughout all the lower departments of life, and which Mr. Darwin so tersely describes as the "struggle for existence," has its true counterpart in society in the industrial struggles of men. The entire social fabric rests on the competitive principle, which is as soulless there as it is in its earlier manifestations. It might be styled the *morals of Nature*. Every being finds all it can do in preserving its own existence, and in so doing

* Professor W. Stanley Jevons, in his "Theory of Political Economy," has enunciated a similar truth. He also there shows that in that particular department the general thought had been given out much earlier by Walras and Gossen, as it had as far back as 1862 by himself.

takes no other account of the means employed than simply their elements of success.*

Were there no additional factors in the problem, the course of human conduct relative to the acquisition of desirable objects would be very simple. Any one who has watched domestic animals, whether horses, cattle, hogs, dogs, or fowls, in the distribution of their food, has observed that, except in those cases where the element of sex clearly enters, and in which a sentiment not distinguishable from that which men call "chivalry" is apparent, or where parental instinct comes into play, no law is recognized except that of power to obtain each its portion, or, if the quantity is limited, all it can of the food allotted, whatever may be the consequences to the weaker members.

With the human race, the same exceptions and no others being made, the naked law of acquisition above formulated and the principle of natural justice would make the products of art and labor—*i. e.*, the wealth of the world—the subjects of a process of forcible seizure and appropriation, irrespective of the notions of proprietorship or of injury to the loser. This is the theoretical condition of the problem of social mechanics, and may be compared with the statement of other problems of concrete science, such as that of atmospheric currents on the globe, which are simple in theory, but assume great complication so soon as the modifying facts of any particular case are taken into the account.

TRANSITION FROM NATURAL JUSTICE TO CIVIL JUSTICE.

The specific problems of social mechanics are, of course, many of them highly complex; but the predominant influences which tend to modify the general theory of natural justice in all states of society at all advanced may be referred to one common source, and, when this is well understood, they may then be subdivided into a few obvious groups.

* Tylor, "Primitive Culture," Boston, 1874, vol. ii, pp. 89, 90, 318; Spencer, "Ceremonial Institutions," p. 47, § 355.

The leading factor which distinguishes the conduct of men from the acts of animals is the greater predominance of the *intellectual* element. This, it is true, is only a difference of degree, but so great is that degree that the results may be said to possess a qualitative distinctness. The problem is, therefore, to determine in what ways this intellectual element enters into the simple theory of natural justice, and what are the character and degree of the modifications effected by it.

In endeavoring to analyze this influence, we find that it may be subdivided into three quite distinct constituents, each of which has done its part to make the conduct of men what it is with respect to the acquisition of the objects of desire. These three subordinate influences are as follows:

1. Increase in the susceptibility to sympathy.
2. Increase in the capacity for foretelling effects.
3. Decrease of the power to perform desired acts.

We will consider these in the above order.

Nature and Influence of Sympathy.—As each of the three modifying influences was alleged to have grown out of the more highly developed intellect of man, it may not be clear to some how this can be predicated of sympathy. It is not maintained that sympathy is itself an intellectual state. On the contrary, as a form of feeling, it is a true social force, but one of those derivative forms which could only be developed after the intellect had become quite strong. The realization of the discomfort of pain in self is the only fact which could generate sympathy for others who suffer it. This sympathy is very early in its appearance. It requires a comparatively small amount of mental force. Many animals show unmistakable signs of such a realization. The hunter's dog, though never shot, will cringe if the piece is pointed at him. He evidently reasons that what will harm other animals will also harm him.

The circle of human sympathy has gradually widened as knowledge and experience have increased, until it has come to embrace, in a few instances, all mankind and even the inferior brute creation. Sympathy is quite a complex phenomenon. It depends upon several conditions: one is, of course, a sensitive organism; but a more essential one is a rational faculty. Its intensity is measured by the perfection of the organism, *i. e.*, its capacity for feeling, on the one hand, and by the strength of the intellect, *i. e.*, the power of representation, on the other. Its scope is also largely dependent upon the range of experience, *i. e.*, upon the degree of intelligence. Hence, the more delicate the sensibilities, the more vigorous the intellect, and the higher the degree of intelligence, the keener will be the sympathies. The psychological law, according to which sympathy is dependent upon the representative powers of the intellect, was fully set forth in Chapter V (*supra*, p. 396). It need not, therefore, be restated here.

This throws light on the genesis of the so-called moral faculty, showing us how it has been produced by the force of external circumstances acting upon the primitive organism.

It remains to be shown that this moral character, so distinct from that of savage man and of animals, constitutes, nevertheless, no exception to the law that all sentient beings must act in obedience to subjective forces—to internal, or egoistic, desires.

The person who sympathizes, as the etymology of the word so literally implies, *feels with* the one who suffers, *i. e.*, feels pain also. Sympathy, therefore, is really *pain*. Hence, every act growing out of sympathy is an act to escape pain suffered by the agent. This act takes the form of relief for the one suffering. It belongs to the class of negative social forces, but is neither less normal nor less potent on that account.

That the moral sentiments themselves have grown out of these simple principles was shown in Chapter V, and will be fully considered in Chapter XI. We have here only to observe their bearing upon the law of acquisition and that of natural justice. The effect of sympathy must clearly be to soften the rigor of these laws, and it will always be felt when the sympathetic force exceeds the acquisitive force, and only in such cases. This will be shown (Chapter XI) to be the essential of altruistic action. It is also one of the chief bases of the conception of proprietary rights. The dispossession of a weaker by a stronger individual by dint of strength alone brings vividly to the mind the discomfort of the individual deprived, and tends in two ways to deter from similar acts: first, by partially neutralizing the acquisitive tendencies of the agent himself, and secondly, by inspiring witnesses of such acts to defend the injured ones by force. It is in this way that has grown up that part of the moral code relating to rights which ultimately assumed its authoritative sanction, in which aspect it belongs to the third class of influences here being considered.

Influence of Intelligence.—A high intellectual development is not alone sufficient to secure great foresight. This requires the addition to that faculty of the requisite registered experience which constitutes intelligence (*supra*, p. 405). The ability to foretell the consequences of action will therefore be measured by the degree of intelligence, *i. e.*, the power of the intellect coupled with the amount of knowledge acquired.

The power to foretell the consequences of conduct modifies the severity of natural justice by deterring individuals from attempting to employ force in those cases where if employed it must fail or seems likely to fail. The mere pausing to calculate the chances would prevent a large percentage of such attempts, and the effect would be equally good whether the attempt in fact succeeded or failed. The success or failure of such attempts is of no sociologic importance, since all the operations of the social forces are important only in their indirect effects. If the jars and discords are prevented, this is all that is noted by the sociologist.

The full force of this influence will be better seen after considering the next.

Restriction of Acquisitive Powers.—The third and perhaps most important influence which has tended to mitigate the law of natural justice has been the gradual restriction of the acquisitive power. While sympathy has done much toward this end, and intelligence has aided at least in a negative way, the sense of insecurity and the necessity for protection have been the chief elements in rendering it successful. This result is accomplished principally through the several *codes* which have grown up in society, and which can be more conveniently treated a little later.

The effects of these three palliating agencies will now be considered in their *ensemble.*

GENESIS OF CIVIL JUSTICE.

We are now prepared to consider the question, How far has *natural justice,* or the "right of might," been modified by the transition to civil justice? How much of what we term loyalty and respect for the rights of others can be attributed to sentiment—to a subjective force—and how much must find its explanation in circumstances, or an objective force? How law-abiding would men be of their own accord? Involved in these questions is the paradox that, while society virtually denies the sufficiency of sentiment and moral character by refusing to abolish its prohibitory laws, it at the same time vehemently affirms such a sufficiency as often as it is questioned. The greater part of this difficulty is sought to be avoided by the claim that society is divided into two classes, one of which does, and the other does not, require the maintenance of these laws whether social or civil. Admitting the truth of this statement, the question is narrowed down to determining the line of demarkation between these classes, between the loyal and the lawless, between those who recognize and accept the human or artificial code, and those who, were the penalties removed, would revert to the natural code.

This lays bare a second paradox, for, while almost any one would say that this boundary lies somewhere between the higher and the lower classes, and while all laws are made especially severe against the low and ignorant, still, the same persons who say this and the men who make these laws might deny, if asked the question, that intelligence or education exerts any influence on morals (*supra*, p. 134, note). An attempt has already been made to solve this perplexity by showing that, although intelligence, consisting as it must of intellectual elevation coupled with the possession of real knowledge, does unquestionably strengthen and promote all the virtues that make up a high moral character, that it does so in proportion to its degree, and that this is the only possible means of securing this object; yet, as actions are the result of the forces in operation within and without, and as these forces, which are the desires, may be disproportionately and abnormally strengthened under peculiar circumstances, it therefore often happens that increased intelligence which really exalts the character, affords a keener appreciation of justice, and intensifies the desire to see it done, increases, at the same time and under the peculiar and unequal circumstances of those involved, the desire to possess what is only obtainable by manifest injustice, by furnishing easy means of thus obtaining it. If the circumstances be such that the latter desire predominates over the former, action follows of necessity, and the injustice is clearly chargeable to intelligence. In other words, knowledge increases the *temptations* to act unjustly at the same time that it increases the desire to act justly, and which one of these is to prevail must depend upon circumstances. It must necessarily follow that, wherever intelligence works evil, it is due to *inequality* of opportunity to acquire knowledge; and this constitutes a powerful argument for impartial education (vol. ii, pp. 535, 596, 607). The line of demarkation which we are seeking must therefore lie between that class of persons whose knowledge has elevated them above the temptations to which they happen to be subject, and that class whose temptations are too strong for their character. It must, therefore, depend upon two different elements—intelligence and circumstances—and vary as these two forces vary. But what I desire particularly to bring into view is the error of supposing that the condition of character which renders a man incapable of larceny or robbery takes him out of the class who obey the natural rather than the human code.

Not all of those who appear to have risen above this natural law have really done so. The moral progress of the world is more apparent than real, especially as regards respect for proprietary rights. This is evidenced in a thousand ways. In fact, it must be assumed as a basis for all legislation and a postulate for every human transaction that men will pursue the course which secures to them the greatest gain. Not gain in its widest sense, as the greatest amount of happiness, but pecuniary or possessory gain. Moral considerations can not be trusted. Moral obligations are voidable at law. Supreme selfishness is presumed in all business transactions. And it is reasonably presumed. To depend upon any thing else is to build upon the sand.

No truth is more trite with students of the human races than that morality is to a large extent a relative term, and right and wrong are reversed by passing from one tribe to another. But there are certain acts whose manifest incompatibility with the continuance of the social state has placed them in a special class and earned for them the name of crimes. These, of course, do not vary so greatly as do minor acts, yet there is great diversity in the conception and definition of crimes among different peoples. So, if we look back, we shall find that certain acts which are regarded as criminal now were not so regarded in a not very remote past, and there is reason to believe that many classes of conduct now permitted will at some future day be declared criminal. Theft is a virtue in some tribes, but a heinous crime in all civilized countries. Lottery speculations are now fluctuating between the criminal and the non-criminal classes of operations, while monopoly seems to be advancing toward the modern conception of criminality.

The fact to be noted is, that, while these conceptions of criminality are advancing, the great primary law of acquisition is perpetually devising means to evade their influence. If public sentiment takes the form of prohibitory law, a way is found of securing the same object without violating that law. Just as at the outset the method was subordinated to the end sought, when the former took the most direct and obnoxious forms, so now it is equally subordinated when it is compelled to assume the most gentle and refined forms. Where physical force fails, intellectual force takes its place. In the matter of checking the operations of the law of acquisition, civilization has produced scarcely any effect. The effect it has produced has consisted in softening the method and mitigating the severity of the operations of that law. While this has been a great and permanent gain, its advantages are apt to be exaggerated, and the real character of the substitutes for the primitive methods is frequently misunderstood.

As already remarked, the chief effect produced by social regulation in altering the methods of acquisition has been the substitution of cunning for brute force. We may glance at some of the illustrations of this change.

Notwithstanding the fine array of maxims so constantly quoted to encourage honesty in the mutual dealings of individuals, scarcely a transaction is ever consummated without some form of deception having been practiced. What is understood as the ability to "drive a bargain" is nothing more or less than a certain species of cunning, in making the facts appear in some way different from what they are, whereby others are somewhat deceived and beguiled into paying for an article, perhaps not more than it is worth, but more than they otherwise would have done. It may not be too much to say that very few dealers who gain their livelihood in trade can afford to be strictly honest in all things according to the received standards of honesty. It is a fair subject for doubt whether such a course would not in many cases be ruinous to their interests. If all buyers and sellers would live up to such a standard, there can, of course, be no doubt that this would be the best course, but, taking society as it actually is, the strict integrity of any one individual, except within a very narrow circle of those who know him well, would probably operate somewhat to his disadvantage. Every one expects every one else to practice a certain amount of what is thought by each in his own case to be justifiable deception, and one who should fail to do so would scarcely be adjudged possessed of the full complement of intellectual powers, or, as it is called, wits. For so insensibly does open falsehood shade off into the mere exercise of the normal degree of intelligence that no absolute line of demarkation can be drawn. These small forms of deception, never rising to the violation of any positive rules, either of law, morals, or propriety, are among the modified methods by which the law of acquisition asserts itself within the restricting meshes of the social net-work. The end sought is no longer accomplished by force but by cunning. Truth is pushed to its extreme limit on the side of advantage, and perhaps supplemented by a shrewd *suggestio falsi* without being accompanied by any actually false statement. The *suppressio veri* is freely employed, the impression prevailing universally that nothing wrong is done, unless a positive falsehood is resorted to, although an ideal morality would rate the degree of wrong entirely according to the effect produced by the deception regardless of the form in which it was presented.

Take, next, those classes of business, in conducting which certain persons, owing to the circumstances by which they have known how to surround themselves, have, almost without effort, made large accretions to their stock of wealth, such as certain speculations in stocks and securities, and much that goes by the name of perfectly legitimate and honorable banking or brokerage. These are also illustrations of civilized forms of acquisition, wholly within the pale of civil justice. The man who can add thousands to his wealth in a moment by dictating an entry in a book, is congratulated by the community in which he lives and by society at large. Yet such a transaction can not fail, in the present state of society, to take bread from the mouths of hundreds perhaps of suffering poor, at one point or another within the radius of this man's financial influence.

Many other classes of cases might be adduced, including those popularly ascribed to the legal profession, the tendency of which in this direction is perhaps popularly overstated. Such cases will suggest themselves.

But why can men no longer seize property? Because of social organization, of course. Does not the fact of social organization, then, argue a disinterested morality? Why has society vouchsafed protection to its members? Has it not done so because of a humane and disinterested sentiment which exists in the human bosom, and which has simply found expression in a beneficent scheme of protection? Does not the existence of laws—civil, social, and moral—protecting property and guaranteeing rights, demonstrate an original altruistic sentiment? Not at all. All this has been a growth. Once it did not exist. It owes its development to that of intelligence. Protective regulations are products of human sagacity, manifestations of the intellectual force. They constitute the method which mind was compelled to adopt in order to thwart mind. They were instigated by and on behalf of the victims of human wiles.

Government (and I use the word now in the broad sense of protective social co-operation) was devised, so to speak, in order to escape imposition and abuse. It was those who suffered who helped establish it. But it so happened that all individuals were sufferers and wrong-doers at the same time. All were liable to encroachment and all were disposed to encroach. Thus it came about that each, in agreeing to rules for his own protection, estopped himself from the commission of violence. As, in each particular case of seizure or violence, the number affected by it, and frightened by apprehension of being the next to suffer, must have been far greater than the number committing it or to be benefited by its commission, it was always easy to secure a measure calculated to prevent the repetition of any particular act. And so of every other act. It thus came about that every man consented to conditions which limited his own action. The great *plexus* of rules which constitutes the civil, the social, and the moral codes, has been woven in just this way. Not that men have had to go through the form of assembling and adopting each of these rules. It is sufficient if they have become binding upon all the members of society. The exact method of their adoption or enforcement is quite immaterial. They have grown up in society, have been the results of human sagacity, cunning, or intelligence, have been devised by the victims of these same attributes, and have become binding upon all the members of society. It is to these three *codes*, as I denominate them, that civilized society owes its protection of rights and its immunity from arbitrary violence. Let us examine these codes a little more closely.

The *civil code* embraces the whole body of the laws which it is the province of government to establish, sanction, and enforce. There is an infinite number of ways in which such laws are created. The four principal of these are: 1. Arbitrary edicts of chiefs and absolute despots. 2. Edicts of emperors and kings, based upon or sanctioning the opinions of eminent jurists. 3. Statutes of legislative bodies. 4. Decisions of judges upon actual cases, enforced by mutual consent in all future similar cases, though reversible under certain circumstances.* The nature and origin of each of these are clear to all, and each has had for its object the real or pretended protection of the individuals in whose behalf it has

* Blackstone's "Commentaries," vol. i, Introduction, section iii.

been called into existence. (For a fuller discussion of this subject the reader is referred to Chapter X, where the institution of government is more especially treated.)

What I understand by the *social code* is, that body of rules, limitations, and conditions which society has gradually built up to cause its members to observe *propriety* in all their acts. It embraces all the forms and conventionalities of society, covers the whole field of fashion and appearances, and aims to enforce uniformity, regularity, and consistency between the acts and the circumstances, and to abolish all eccentricity and indecency. Although a *lex non scripta*, it is, if possible, more inexorable than the edicts of despots or the statutes of states. The feeling experienced in its violation is more intolerable than any corporal punishment or personal confinement. It prevails in all countries and all forms of society, although so whimsical and irrational is it that often what is violation of it in one country or age is obedience to it in another. Although supposed to be confined to indifferent actions, its boundaries often encroach so far over upon the territory of civil law on the one hand, and moral law on the other, that it should not be omitted in a consideration of the self-imposed limitations of society. Actions are constantly passing backward and forward from one to another of these three codes, according to the age and degree of intelligence of the society in which they are performed.*

The *moral code* is designed to limit the members of society in the commission of actions which tend to cause pain or deprive of pleasure. All unwritten as it is, it has assumed the most definite form, and acquired a powerful binding force. Like both the others, it has been a growth, and has arisen out of the wants and necessities of society, and like the social code it is exceedingly capricious, changing, and irrational in many of its mandates. That it is not a natural

* Lubbock, "Origin of Civilization," p. 254; Carpenter, "Mental Physiology," pp. 243, 485.

system, owing its sanction to an unerring monitor called conscience, I shall hereafter endeavor to show (vol. ii, pp. 340, 349, 441, 451).

All three of these codes, or systems of law, with their multiplied general and special regulations, and their inevitable penalties, are but the restrictions which society has placed upon its own action. Independently of their reasonableness and justice, which depend in the main upon the degree of intelligence and the amount of knowledge possessed by society, they are what essentially distinguishes civilized from savage man. They are the covenants of protection from arbitrary encroachment which society has made with its members. So binding has this so-called "compact" become, and so closely woven is the net-work of fibers, that however great may be the desire of one individual to encroach upon another, he feels that the attempt if made must be fruitless. In fact, the rude violence of barbarism is rendered physically impossible.

It has been shown that the law of acquisition—*i. e.*, the desire to acquire regardless of the method—is as strong now as ever, and that the progress made has consisted in mitigating the harshness of the method. We now see that this change of method has not been voluntary and due to altruistic impulses, but is chiefly compulsory and the result of an actual inability to apply barbarous methods.

This brings us to the consideration of what may be called the major evils which the love of gain has wrought. Thus far we have considered only the minor evils. The thousand petty arts and deceptions which it makes men practice upon one another, great as their accumulated effect undoubtedly is, are but peccadilloes compared with the extensive system of wrongs which are quite unconsciously committed by great organizations, whether governmental, ecclesiastical, commercial, or financial. When we look over society and behold the condition of different classes of the people, the exceeding indigence of the poor and the exceeding opulence of the rich—when we reflect that throughout the world the tendency of civilization itself is to "make the poor poorer and the rich richer,"* and that all this is done according to law, in obedience to all three of the codes described and to the conscience—how can we longer doubt that the human race is just as eager for gain and just as indifferent as to the manner of securing it as it ever could have been in the most barbarous ages? Man obeys these several codes because he must, but, whenever he can secure an acquisition outside of these, or, as it were, *ultra vires*, he always avails himself of the opportunity at whatever expense to his victim and the rest of mankind. Indeed, the very existence of these restrictions seems to afford him an adequate apology for any thing he may do to which they do not apply. If only he avoids the *malum prohibitum*, he cares nothing for the *malum in se*. Just as observing the Sabbath and conforming to prescribed religious canons furnish an excuse for ignorant people to commit all manner of wrong on other days and outside of those canons, so do the civil, social, and moral laws of society afford a justification for all acts not expressly forbidden by these laws.

This can not be better illustrated than by reference to the principle that in matters of government an unrepresented class is always deprived of its rights. If history and experience ever taught any thing, they have taught this principle.

* Under the natural, or spontaneous, system of society, the accumulation of wealth proceeds in a manner exactly the reverse of that best suited to the true advancement of social and individual welfare. Instead of its equitable distribution in proportion to the amount each contributes to its production, it tends to concentrate in the hands of those who produce least. Equity would require that the difficulty in obtaining wealth should increase in some direct ratio to the amount obtained. In fact, the difficulty rapidly diminishes as the amount increases. Equity would require that the extra burdens produced by unforeseen events should be chiefly borne by those who have already an abundance. They are ultimately borne by the laborer who has little or nothing. In most countries even taxation, which one would suppose must necessarily be drawn from capital, is in great part drawn directly from labor in the form of duties, or imposts, on articles of universal consumption.

No matter how grievous the wrongs to be suffered, or how loud the protestations of philanthropists, it will all avail nothing until the victim class is represented and its voice is heard. What is the meaning of this fact? What is it to be represented? It is to be clothed with power. This shows that rights can only be obtained by force, that the only limit to man's efforts to acquire is his power to succeed, that the only way to secure justice is to enforce it, and that human right and natural right are essentially one. Simultaneously with the philanthropy and benevolence which we see practiced on a small scale every day around us, there exists on a vast scale a great organized system of wrong unconsciously perpetrated outside of and above all the codes, and innocently participated in even by those who make the greatest display of charitable and philanthropic proclivities.

There is no escape from this principle. It lies deep in human nature. All attempts to soften the human heart must fail. The only wise thing to do is to admit the facts and calculate the consequences. Without assuming to dictate what human nature ought to be, the only rational course is to recognize what it is, and act accordingly. Instead of trying to dissuade men from taking away the property of others, society must render it impossible for them to do so. The proper way to induce men to desist from unjust action is to make it for their own interest so to do, and teach them in an unmistakable manner that it is so. This is the work of intelligence and education. Legislation of this class we have called *attractive* (*supra*, pp. 39 *et seq.*), and it is in harmony with the deepest principles of social science.

The appropriateness here of the argument that unrepresented classes are necessarily deprived of their rights, arises from the comprehensiveness of the influence of property. As has been already remarked, every thing valuable in the world either consists of acquirable property, reducible to money, or else is so intimately associated with such property or money that, if the latter did not exist, it would cease to possess any value. Hence, to be deprived of rights is the same thing as to be deprived of property. The greater part of the oppression practiced in the world has been of this kind. The first step toward taking away liberty or life is to take away property. It is but a step from penury to slavery. Who shall calculate how large a part of all human suffering is due to poverty? And what is the cause of poverty? If the true share of indolence in occasioning poverty could be known, it would be found to be small. If the whole subject could be thoroughly investigated, it would appear that the poorest people in the world are, if not the most enterprising and energetic, at least the most industrious and laborious. Those who are poor because they are indolent bear but a small proportion to those who are poor and yet industrious. Another fact would be developed, viz., that the indolent rich bear a far greater proportion to the industrious rich than the indolent poor to the industrious poor. We should learn, as has already been remarked, that those who have the honor of producing wealth rarely have the pleasure of enjoying it.

Let us pause and ask the cause of this pecuniary inequality. One says it is because some have more brains than others, and know how to acquire and take care of property. I accept this as a partial explanation, and in so far as it is true it can be stated in this manner: Some have more (intellectual) power than others, and by means of it they withdraw property from the weaker ones according to the law of acquisition above set forth. This is the sociological form of stating the fact, and, if the advocates of brain-titles can derive any consolation from it, they are welcome to enjoy it. But, when they assert that the brain-power which qualifies a man to accumulate the wealth that others have created is the same brain-power that moves the wheels of social progress, they commit a very serious mistake. That quality of mind which enables a man to amass wealth, accumulate property, and, as the phrase goes, "make money," though doubtless one of the most useful, is, at the same time, one of the coarsest and cheapest of all mental attributes. The pleasure it confers is a sordid pleasure, and the results of its activity are wholly statical. Nothing progressive is ever directly either involved in or evolved out of it (vol. ii, pp. 477, 599). True, indirectly and unintentionally the accumulation of wealth has advanced the race by affording leisure for a few to think out and develop natural principles, and by enabling large schemes of improvement to be carried out for which small fortunes would not have sufficed. This, however, was not due to this quality of mind, but to circumstances which it engendered, always and necessarily coupled with those other qualities of mind which are intrinsically progressive. This "money-making" faculty of the human mind only represents the brute-force which was exerted as long as it availed for seizing, or, in any way whatever, getting possession of property. Changed in its method to suit the changed circumstances, but unchanged either in its object or its spirit, it still maintains its arbitrary sway, drawing all value toward the strongest centers of attraction with no more feeling for the weaker ones who lose than one magnet feels for another. And the phenomena which it presents are as natural, when viewed from a sociological stand-point, as are those of magnetism. It is not the best things in the world that succeed best. It is not always the most perfectly organized species of animals that survive, nor the least perfect that are extinguished.* In

* This truth is clearly illustrated by many highly developed forms of plants, as, for example, the *Orchidaceæ*, which seem to be effecting their own extinction by over-development. This, however, is probably to a great extent due to specializations acquired to correlate them with certain insects, which latter, for any reason, may have become scarce, or be restricted to a narrower geographical range than the plants otherwise would be. The last case is known to be that of the *Yucca*, which, when artificially fertilized, flourishes much farther north than the northern limit of its *accoucheuse*, *Pronuba yuccasella*. The general law is also well exemplified in the paleontological history of both the vegetable and the animal kingdoms, where, as it seems, each branch of the genealogical tree has developed in size and structural organization until it has surpassed the limits of possible existence, and perished from this cause.

human attributes, as in animal organisms, it is those that are best adapted to the particular circumstances of their existence that thrive best and propagate most rapidly.

Nature is at once the most practical and the most prodigal of all economists: practical, in that she never makes an organ or an attribute which has not the elements of immediate and direct utility in accomplishing one or the other of her distinctive objects—preservation and perpetuation; prodigal, because she spares no expense to accomplish even the least results in these definite directions (vol. ii, pp. 87, 494). A million eggs are not too many to cast upon the waters if a single fish can be thereby produced. Earth, air, and sea are full of vegetable spores, only a minute fraction of whose infinite number can ever germinate. The greater part of all created beings perish by violence or the elements. Any one species would soon infest the whole world to the exclusion of every other, if this were not so. Nature seems to turn all her creations out loose together to prey upon and jostle against one another, crushing out the weaker, and thereby preserving and perpetuating the stronger. Strength is the key to success in this struggle. Man is a child of Nature, and mind an attribute of man; mental qualities, therefore, obey this law, and only those best fitted in this sense survive and thrive.

The time has not yet fairly come when the finer and nobler qualities shall be those best fitted to preserve, strengthen, and perpetuate themselves. We are still in that part of the great circuit of psychological development where the coarser and ruder qualities are those best adapted to achieve success. We have passed through the stage when muscle prevailed over brain, but we have not yet reached that in which reason shall prevail over passion.

The passion of avarice, whose genesis we have been tracing, is a normal product of the great preservative force. It is the power which nature is employing to preserve the human species, and can only be checked and made harmless by the intervention, or rather the supervention, of the higher, more subtile, and more penetrating intellectual attribute whose deeper calculations shall outwit the coarse cunning which expends itself on gain, even as this latter has supplanted the clumsy dynamics of muscle. In each and all of these cases, however, it must be force in one form or another that is to triumph; but that force is destined to grow more and more refined and spiritualized, until, let us hope, it will at last secure the object of man—his happiness—as it always must that of nature—his preservation.

The pecuniary inequality of mankind, therefore, sociologically considered, is likewise the result of the natural operation of the preservative forces under the peculiar conditions to which the race is subjected. It admits of a satisfactory genetic explanation, and, in a philosophical sense, is both necessary and proper. From the stand-point of Nature and her objects, like all else that exists, it is right; but, when viewed from the stand-point of man and his objects, it admits of little justification. Under the ethical code of Nature that every thing is right which conduces to the preservation of life, this great struggle for possession is eminently practical and useful, but, under the ethical code of man that every thing is wrong which causes pain, it is fraught only with evil and injustice. Viewed from a biological stand-point, it has been man's greatest blessing; viewed from a moral stand-point, it has been his greatest curse.

But, when we say that the pecuniary inequality of mankind is due to a corresponding inequality of brain-power, even if we limit this brain-power to the "money-making" quality alone, we have gone a great way too far. We have left out one of the most important elements in the problem. We have only stated the subjective side of the question, and have neglected the objective side. We shall never be wholly right until we remember that this inequality of possession is due to a corresponding inequality of *circumstances*. The inequality of brain-power is only the subjective part of these circumstances. We must also consider the objective part, the external circumstances which surround each individual, whether belonging to the fortunate or the unfortunate class. Men come into the world and find themselves loaded with wealth or destitute of all proprietary interests. They are born millionaires or beggars. They open their eyes upon boundless plenty or upon abject poverty. They merit neither praise nor blame for the conditions under which they exist. However commendable intellectual qualities may be considered, they have nothing to do with these external circumstances over which we have no control. From the point of view of human morality, far better grounds of justification could be found for the state of social inequality we are considering, if it could be attributed wholly to a corresponding inequality in any, however low and coarse a faculty of mind. We should feel better satisfied to say: It is an inherent necessity; those who have not intelligence enough to acquire or retain must not expect to possess. Philosophers could then only look forward to the remote period when the higher altruistic attributes should gain ascendency over the lower egoistic ones, and augment the power of sympathy as a social force. But when we find that a great part, perhaps the greater part, of this painful inequality is the result of mere accident, as devoid of mental or moral character as are the inequalities of the earth's surface; due to some bare fortuity, some physical fatality, some accidental coincidence, some ancient social convulsion, some act of remote ancestors, or some vice or virtue of parents—when we look at this aspect of the question, it requires the broadest charity as well as the profoundest philosophy to refrain from exclaiming with Tully, *O tempora! O mores!* No merit which may be supposed to inhere in superiority of mind, not even of the sordid passion and talent of money-getting; nay, not even the questionable merit of superior brute-force, can enter here to palliate the state of things. We see only the cold, feelingless fingers of natural law as it rides in its icy chariot through the universe. We get a foretaste of the inexorable character of Nature, and find ourselves more ready to believe her capable of blotting out our central source of light and warmth and life, and quenching, in her slow, imperial way, all the vitality, feeling, thought, and intelligence which have been evolved. When we reflect upon these immense sociological facts, we realize more and more that there is a dark side to the picture presented by the operations of the preservative force, we see more and more clearly that in its grand career of development civilization has left a blackened trail and smoking ruins in the domain of feeling.*

Modes of Acquisition.

When treating of the law of acquisition, we noted that the *modus operandi* of the preservative forces consisted in continual and repeated efforts on the part of individuals to possess themselves of the objects of desire, the essence of that law being that this class of phenomena are *natural*, in the scientific sense that they may be depended upon to occur at all times in the same manner as physical phenomena can be depended upon to occur.

It remains to show that, just as physical phenomena which have been reduced to laws may, and always do, have various *modes of manifestation*, varying with the particular circumstances and external influences by which they are surrounded, so these social phenomena of the preservative class, when reduced to the general law of acquisition, have in like manner their modes of manifestation depending upon like causes. These various modes of manifestation may be more definitely named modes of acquisition, and it is to this next less general branch of the subject that we have now to turn our attention.

* For a fuller exposition of the necessitarian doctrine, as the only explanation science is able to offer of the origin of evil and kindred problems, see Vol. II, pp. 35, 114.

In the treatment of the several problems involved in this discussion, it is proper to disclaim at the outset any attempt at detailed analysis or at the bringing forward of ethnographic proof in support of the positions taken. Such an attempt would obviously carry us far beyond the necessarily circumscribed space which has been allotted to this discussion. It is believed, however, that, in so far as such facts are applicable to them, these positions will be found to harmonize entirely with all that has been thus far brought to light by the students of the existing lower races and of the archæologic remains of prehistoric ones, while no one will expect that just these deductions will have been made in all cases by writers upon those subjects. It will, therefore, be sufficient if these conclusions do not conflict with the established facts of anthropology, as discovered by such investigators as Mr. E. B. Tylor, Sir John Lubbock, Mr. Lewis H. Morgan, or Sir Henry Maine.

It is important to observe that the point of view is wholly different from that of any of these writers, or perhaps of any other writers. It is not from an anthropological or ethnological stand-point that our treatise proceeds, but rather from a strictly sociological or socio-economic one. The method is necessarily systematic and synthetic, not discursive or analytic, and, to be fairly judged, the ultimate truth underlying the chapter, viz., the natural evolution of the social organism, which is denominated Sociogeny, must be steadily kept in view.

CLASSIFICATION OF THE MODES OF ACQUISITION.

So soon as we leave the theoretical pre-social, vegetarian stage, we find that nearly all the objects of desire must consist of articles which possess value chiefly or wholly from the amount of labor that has been expended upon them. These products of human labor, taken collectively, as well as the process itself, are, in economic parlance, denominated *production*. It is, therefore, only such articles of production that become the legitimate objects of acquisition, and the classification of the modes of acquisition must be based upon production. But acquisition, although it presupposes production, does not necessarily imply this of the agent pursuing the object produced. It may have been produced by another. The acquisition of objects produced by others than the agent may further be of two kinds, according to whether the act of acquiring be one necessary to the full utilization of the article acquired, or wholly arbitrary and in no way affecting it.

It will be convenient, while it can in no way diminish the perspicuity of the classification, primarily to subdivide the agents instead of the acts, and to treat the latter as subclasses of the general social factors.

We shall thus be able to divide mankind into the three primary classes; as, 1, producers; 2, accessories to production; and, 3, parasites—the last two classes constituting the non-producers.

The different forms of activity manifested by each of these several groups will be classified and treated under their appropriate heads.

Producers.

The silence of nearly all human history upon the industrial condition of man is notorious, yet every one knows that long before a line of history had been written the needs of mankind were supplied by extensive systems of artificial production. Ages before history began, the great work of producing wealth had gone so far that the parasitic class had firmly established itself, and subsisted upon the surplus over the wants of the producers. Not only were royal families and priesthoods thus supplied, but great non-producing and wealth-destroying armies were kept up in this way.

It is a little surprising, therefore, to find Mr. Herbert Spencer, who must be aware of these facts, and who frequently condemns the historians for their superficial treatment of events, speaking of "essentially militant" * types of society. If he merely means that certain tribes and nations are far more warlike than others, it is true enough; but he seems to convey the idea of societies in which war is the chief and permanent occupation. The impossibility of such a state, considered as at all permanent, is manifest. And when warlike nations plunder industrial ones they are soon compelled to restore in some way the industrial state. In fact, all "militant societies" must rest upon an industrial class, while the military operations, however incessant, depend chiefly upon simultaneous industrial operations.

Production, in its widest sense, signifies the bringing of any enjoyable thing into available form. It implies that, by means of labor, something not previously available for human use is rendered so, or that something less available has thereby been rendered more so. It does not, however, imply any necessary proportion or correspondence between the amount of labor performed and the amount of value produced, although an individual becomes the producer of a commodity only in the proportion which the labor he has expended upon it bears to the whole amount of human effort put forth in its production. Still, no matter how small the amount of labor, or how great the value, the act of making that value realizable is production. This definition properly excludes the mere transfer, whether forcibly or peaceably, of an unchanged commodity from a condition advantageous to one to a condition advantageous to another. Again, although specially considering the objects of human subsistence, it is proper to say that the term *production* is not thus confined within the limits popularly regarded as practical. It comprehends all enjoyable things, whether they are calculated to promote the object of nature—the preservation and perpetuation of species—or that of man—enhanced enjoyment—and whether that enjoyment is to be derived through the lower senses or through

* "Principles of Sociology," vol. i, § 268.

the more refined ones, such as the eye, the ear, the emotional centers, or the brain. It embraces the whole range of the practical and the fine arts, the physical, the intellectual, and the spiritual susceptibilities.

CLASSES OF PRODUCTION.

In their pursuit of subsistence, *i. e.*, of food, clothing, and shelter, the first producers must, in all probability, have confined their labors to the three great industries: hunting (and fishing), tending their flocks, and tilling the soil. Each of these, as I have before remarked, presupposed a certain amount of native sagacity, or intellectual superiority, sufficient to raise man into clear distinction from the animals with which he was surrounded and over which he must exert control. But, notwithstanding the various devices, deceptions, and *arts* to which he must resort in any of these pursuits, the labor required for his success in them, and the species of mental effort required to direct that labor, should be distinguished from those of art, properly so called. The distinction, it is true, is rather convenient than fundamental, since all efforts of mind can be generalized into this one; still, to the superficial view, the distinction is obvious enough. The line of this distinction seems to lie partly between the effort required to circumvent the animal species and that required to subdue the physical forces, and partly between that species of thinking which leads men to profit by experience and observation and that which enables them to anticipate adaptations and the relations of circumstances not yet experienced or observed. But, whatever may be the philosophical laws which underlie them, the two kinds of industry are unlike and more widely distinguished than any of the varieties presented by the forms of either among themselves. The one may be called the primary, direct, or original; the other, the secondary, indirect, or derivative mode of production. Although, chronologically, these two modes are not to be separated, since the first could have scarcely attained a distinct form without some assistance from the other, and that could not exist at all alone, still, for the sake of perspicuity, they may be treated separately.

Primary Production.

Of the three great classes into which human subsistence naturally divides itself, viz., food, clothing, and shelter, the first was almost exclusively the object of the *primary* mode of production. The other two, and all the auxiliary appliances for realizing the first, resulted from the adoption of the secondary mode. Confining ourselves first to the former, we naturally look back once more for a moment to the primitive epoch and the primordial activities. We reflect once more that the first and greatest of all desires is the desire for food. The incessant waste of the tissues renders it a perpetual force, never to be reduced to a statical condition, except for a short interval. Failure to supply the materials for renewing these wasting tissues intensifies, within certain limits, the action of this force, and spurs the agent on to the severest possible efforts. The unsatisfied body calls all its faculties into exercise. The senses become sharpened in order to discover the objects of physical nourishment in places where, and at times when, duller senses would fail to detect them. The muscles become developed and adapted to securing them in ways that would be impossible for less agile and less powerful physical frames; and, when these means fail, as they soon do, the guiding power of the intellect comes forward and points out new and fertile avenues to physical supply, safety, and life. It is here that production, in the proper sense of the term, begins. The prior development of the physical system in a pre-industrial state, adaptation of the body to surrounding circumstances, provision for means of effective offense and defense, sharpening of the senses for detecting and securing nutritive substances—all this is the routine of natural selection, and becomes the history of every species. But, notwithstanding this, a limit is soon reached beyond which no species can pass. All aspire to universality, none are permitted to reach it. Each, by its encroachments, becomes the enemy of every other, and each, by its multiplication, becomes a barrier to its own progress; for, thus far, Nature alone is the producer, and no perfection of organization can draw from her an increased supply.

The natural resources of the earth are soon exhausted by the teeming myriads of living organisms subsisting upon it. The point at which this exhaustion takes place is where production begins. Production is teleological. It consists in such human actions, guided by intellectual prevision, as are necessary to direct the natural forces into productive channels. It is the combination, concentration, and focalization of natural forces, including those of the human body and of the bodies of other living beings, in such a manner as to increase the supply of those objects which protect and nourish the body and satisfy want.

SOURCES OF FOOD.

So far as the supply of food alone is concerned, the general directions which this activity has taken are few and simple. Multitudinous as have become the kinds and qualities of food, they all come at the most from three original sources, either from the mineral, the vegetable, or the animal kingdom. That definition of nutritious substances which confines them to organic matter is too restrictive, and can not be admitted under any rational view of what nutrition itself consists in. If there is to be applied any one distinctive test, it is that of being necessary to the life of the organism. It must, for example, be necessary to supply some one or other of the wastes which are perpetually taking place in the system.

Food distinguished from Medicine and Poison.—The distinction between food and medicine is sometimes very nice. The former supplies the natural waste, the latter repairs unnatural derangements. But, since many derangements of the body are occasioned by an excess of waste in some component part of the tissues—since, indeed, any lack of supply for these wastes must result in derangement—the line between food and physic becomes difficult to trace. If they are to be separated at all, the only means of doing so is to confine the latter to such drugs only as operate to remove obstructions (*i. e.*, excess of any thing in the system, whether alimentary or not), and to stimulate the nervous system to the better performance of its functions. But this definition excludes from the *materia medica* all those substances which aim to supply a want, and classes them under dietetics. I see nothing improper, however, in this, and believe that not only should this be done, but that such substances should, when recognized as foods, be administered as such, *i. e.*, in an alimentary form as far as possible, and not as medicines. And even this is not enough—the number and quantity of substances of the other class, the medicines proper, or remedials, should doubtless be greatly diminished, and administered with far greater caution than is usually done. Any proposition looking to the contraction of the domain and influence of medicine should be received with favor by all true friends of hygiene. It might perhaps be adopted as a general rule that all substances which are not foods are poisons, and then the number and frequency of the exceptions could be reduced, by careful scientific study, to the minimum.

All substances, then, which are ever introduced into the system, may be reduced to three classes—foods, medicines, and poisons. Those which neither supply natural loss nor remedy disorganization must produce disorganization. The mechanism of the body is too delicate to warrant us in assuming that extraneous matters can be introduced into any part of it and produce no effect whatever. If not needed to supply a deficiency by digestion and assimilation, or to remove an excess accumulated in some part, or to stimulate the nervous system to a better performance of some or all of its functions, such matters must be a detriment to all the organs within their influence. So, too, the remedial state passes into the toxical as soon as there remains nothing to remedy, and even foods become poisons the moment they are introduced in excess of the demand.

Mineral Foods.—As already remarked, foods are of three kinds, animal, vegetable, and mineral. It is respecting the last-named group that all discussion of the correctness of this classification must occur. But, under the broad definition above given of the term food, there no longer remains any room for such discussion. It need not even be introduced through the alimentary canal, and, indeed, the most important substance taken into the body enters the lungs and mingles immediately with the blood. This same oxygen of the atmosphere might also come in under the above definition of a medicine, since, at the same time that it supplies the vehicle of nutrition, it performs the office of scavenger of the system in carrying away the effete matter which the life-current brings to its gates. So loose are the most technical of terms, when employed to describe the complicated machinery of the organic world!

But there is no lack of mineral substances which are absolutely necessary to be taken into the body through the ordinary channels of food, and conveyed by the circulatory system to the required place to be deposited as normal and essential tissue. The very skeleton and frame-work of the body, as well as the organs of mastication, are composed of mineral matter, while the muscles and all the organs of the body, particularly the brain, are known to contain various kinds of mineral salts, and the blood itself owes its nutritive efficiency to the presence in it of one of the chemical elements—iron. What food is more universal, more lavishly partaken of or more indispensably necessary to the health of man than the chemical compound chloride of sodium, or common salt, usually quarried from the mines of the earth? That the greater part of the mineral substances required by the system are introduced into it along with organic substances, either vegetable or animal, which have previously absorbed and utilized it, does not render these the less mineral in their nature, since they are found there in their inorganic state. It only proves that not only man but all animals and all vegetables require both those chemical elements which enter into the organic compounds, and also pure inorganic mineral matter, for their proper growth and nourishment. Finally, we may enroll among the mineral foods required for man's subsistence, and of which the greater part of all his tissues are composed, that universal element, water, which Nature affords with a lavishness corresponding with the profuseness with which she employs it in the composition of living organisms.

Organic Foods.—The foods derived from the mineral kingdom, although just as indispensable to the system as others, differ from the organic foods in a variety of respects. The most important of these is their failure to supply either nutrition proper or warmth to the body.

Nutritive Foods.—Nutrition, in its broadest sense, includes, it is true, every element needed by the body to maintain perfect health, as well the salts and iron and the fluid solvents as the organic compounds of foods. But in the more ordinary sense the term is restricted to those substances which are supplied to the blood by the digestive process and deposited by it in all parts of the body in the form of organized tissue, whether as muscle, cartilage, tendon, fascia, or aponeurosis. Most tissue is found to contain nitrogen in the form of albumen, and the kinds of food which supply it are classified under the head of nitrogenous or albuminous foods. They are highly organic, having feeble powers of resisting decomposition and change. Chemically considered, they present a variety of forms, depending chiefly on the relative proportion of their principal elementary constituents, which are always carbon, hydrogen, oxygen, and nitrogen, and usually sulphur. These nitrogenous, or azotized, substances, which are known to organic chemistry under the names of albumen, fibrine, caseine, etc., were denominated by Liebig the plastic elements of nutrition, and are what we commonly understand by the phrase *nutritious food.* They supply the body with its muscle, nerve, sinew, and other tissues.

Respiratory Foods.—Equally important, yet perhaps not so obviously so, is the other great class of organic foods which has for its chief function the supply of animal heat, or its equivalent in force, to the body. These are far more simple in their composition, and consist of the same chemical elements as the nitrogenous group except that they contain no nitrogen or sulphur. The combining numbers are, however, much smaller, indicating a much less delicate state of organization, and rendering them far more firmly fixed in their relative atomic proportions (*supra*, p. 306). They are well known under the familiar names sugar, starch, and fat, or oil, and under the more technical names saccharine, amylaceous, and oleaginous bodies. Like the nutritious substances, they appear in a variety of forms, both as food and as tissue, and have received a corresponding variety of technical names. As already remarked, the chief function of these substances, when introduced into the system, is to maintain a suitable temperature within the body. This they do by a process of true combustion. The large quantity of carbon which they contain is brought into perpetual contact with oxygen in the blood, both at the lungs and also throughout the system, which decomposes them and evolves heat, precisely as the same elements produce heat in the combustion of coal or wood. They are called the non-nitrogenous, calorific, heat-producing, or, more commonly still, the respiratory foods. But, when it is remembered that all the nutritive foods contain also all the elements of respiration and heat-production, the superior value of these as foods is apparent, since they are able alone to supply both the great alimentary processes.

Neither of these important ends of physical existence is secured by the introduction of inorganic or mineral matter into the body. To perform the vital functions it requires that these highly organized compounds be constantly supplied in quantities sufficient to replace all the lost tissue, and maintain the requisite temperature of the body.

But, as these substances, no matter how complicated their composition may be, are all resolvable into their original inorganic elements, it must have required some organizing force to have first worked them up into these highly wrought and nicely poised combinations. Moreover, since from their very refinement of organization they must be of a delicate and ephemeral nature, it further requires that this organizing process be constantly kept up and fresh supplies be continually manufactured.

Vegetation the Original Producer of Organic Foods.—What, then, is this great mill where all these fine fabrics are made? It is the vegetable. The process is none other than vegetation. It is the office, so to speak, of the vegetable to organize the mineral for the use of the animal world. The original food of all living things must be of a vegetable nature. All foods which tend at all to nourish or to warm the body, whatever form they may assume at the time they are introduced, must have first passed through the vegetal process. The vegetable foods, therefore, though not more essential than the mineral foods, since life would not be maintainable without either, are yet much more prominent, from the superior importance of their functions. They constitute the main-stay of life, and supply the hourly demands of our ever-changing systems.

Sources of Vegetable Foods.—The number and variety of these foods are very great. The number of plants which contribute to man's sustenance is astonishing. Some one hundred and twenty thousand vegetable species are known to botanists, of which three or four hundred with innumerable varieties are now used for food by civilized man, while uncivilized races utilize a much greater number. All parts of the plant are thus employed, sometimes all at the same time, but more frequently only one or two portions of one and the same plant. In maize, for instance, both the fruit and the stalk are eaten, the former by men and animals, the latter by animals only. The fruit is most commonly the edible portion and that in which the nutritious elements are most concentrated. But there are plants, as the potato, for example, the fruit of which is inedible and poisonous, while some other part (in this case a subterranean tuber) is the receptacle of nutrition. Not unfrequently it is the envelope by which the fruit is surrounded (the pericarp), or the stalk or axis in which it is imbedded (the receptacle), which constitutes the alimentary portion. Again, as in the walnut, etc., it is only the endocarp, or meat of the kernel, which can be eaten, though this is inclosed in a large sarcocarp. In the peach both the fleshy envelope and the seed are eatable, though the latter scarcely so. Yet it is but a step from the peach to the almond, the "meat" of which is greatly esteemed. Thus in trees, shrubs, and herbs, in fruit, stem, bark, and root, and in all parts of each of these, the human race has always succeeded in finding nourishment in the vegetable kingdom. By skill in cultivation and science in propagating the best, man has made the soil multiply its bounties, in proportion as he has multiplied his numbers.

Sources of Animal Foods.—But he has not been content to subsist upon the materials which the vegetable world accumulates, organizes, and enriches. He has demanded that his food be still more highly organized and still more narrowly concentrated. Not satisfied to have the vegetable world bring the inorganic elements into combinations calculated to nourish and warm his body, he has called upon the animal world still further to assort and perfect them so that still less neutral matter might enter his system. Not content with the albumen of the seed and the kernel, he has required the albumen of the muscle and the egg. Not content with sugar and starch, he has demanded tallow and butter. These are the animal foods. Derived originally from the vegetable, by their passage through the digestive and secretive organs of the animal, they become adapted to the formation of tissue, and, in fact, become tissue, which, when the animal is deprived of life, and before sufficient time has elapsed for decomposition to commence, may be transferred bodily to another system, and become a part of its tissues with far less effort of the organs of digestion and assimilation than is required to convert the original vegetable substance into the same form.

The animal is devoted to the purposes of food even more completely than the vegetable. All the soft parts, including the brain and the blood, are converted into food. The eggs, too, of such as are oviparous, and the milk of all such as yield it to any profitable extent, are brought into service and made to minister to the perpetual craving of the human stomach—all must succumb to the irresistible demands of the great preservative forces.

Familiar as all this may seem, this rapid review of the primary objects of human production and of the nature of subsistence may serve to increase our interest in, if not our understanding of, those deep-flowing industrial currents which underlie ephemeral military achievements, national vicissitudes, and political transformations, and, when properly comprehended, greatly exceed them in importance. The latter are but the foam which these powerful under-currents have produced at the surface. The cravings of the human soul for glory, fame, and power, are wholly insignificant in comparison with the cravings of the human stomach for food, and if we will but look we shall see, notwithstanding the obscurity in which history has wrapped them, that the results of these forces are as incomparable as are the forces themselves.

PRODUCTION OF FOODS.

From the consideration of the nature and sources of human foods, let us now revert to the activities exercised in securing them—to the modes of their production. As already frequently observed, they may be reduced principally to three, hunting and fishing, pasturing of flocks, and tillage of the soil. The two first-named modes are confined to those objects of production described as animal foods; the third, in so far as it is purely agricultural, is limited to the production of vegetable foods.

Production of Mineral Foods.—The production of mineral foods constitutes a somewhat heterogeneous class. The chief minerals required by the system, except water and salt, are derived from vegetable and animal substances, into the constitution of which they have already entered. They are, therefore, embraced in the consideration of the other modes of production. With respect to water, it exists in such spontaneous profusion in all habitable parts of the globe that its production consists in little more than its possession. Still the digging of wells is an industry which is not to be overlooked, and in some parts of the world the effort required to obtain water puts a positive commercial value upon the liquid itself. The production of salt has always constituted a special and important industry. It is one of the most abundant of the minerals found on the globe, and exists in a crystalline state, as rock-salt in vast quantities in many parts of the world, and in solution in the sea.

Nothing could be more interesting than to know to what extent and in what manner the early peoples of the globe employed and obtained this universal substance. Speculations as to whether its use may not be a later innovation, and as to whether it might not even now be altogether dispensed with by man, if the change could take place gradually enough, though tempting and fertile in philosophic results, would be out of place here. Data drawn from the customs of savages now existing in various parts of the world, would be extremely interesting and instructive on this point, and form a far better subject for books of travels than much that is treated of in such books. That the ancients used salt almost as freely as we do is, however, clear from the frequent incidental occurrence of the word in classic literature, and this fact alone implies that there must have been a salt industry.

There is no doubt, too, that an extensive commerce was carried on in this commodity, perhaps with Ormuz in the Persian Gulf, though more probably with Syria, where, in the region of the Dead Sea, it still abounds. There might also have been evaporating processes to obtain it from the sea.

Its use by prehistoric races is, of course, unproved, but there is little doubt that no people were ever long without it. It is to be supposed, therefore, that the mining and manufacture of salt must have constituted an extensive industry from time immemorial, and that its transportation to points remote from the mines formed an important part of the commerce of the world.

The pursuit of mineral foods is, however, a wholly insignificant fact when compared with that of either vegetable or animal foods. Although, perhaps, not chronologically correct, it is more consistent with the theory of subsistence to consider these last two in the order named.

Production of Vegetable Foods.—If we suppose man to have descended from the *Quadrumana*, we must regard him as originally quite herbivorous, and, from whatever natural family we may derive him, his anatomical structure seems to indicate a vegetarian life in the animal state. Even the weapons, with which he seems to have once been provided, are rather those of defense and of attack upon his own kind than of a nature to seize upon his prey. They were most of them apparently designed to battle with male rivals, and hence their vestiges are much more marked in men than in women. The only fact which seems to negative the theory that man was originally a pure vegetarian is that, in his savage state as we now find him, he usually subsists chiefly on flesh. The phenomenon of change of habit from a granivorous to a carnivorous, or at least to an omnivorous condition, is, however, no obstacle, as it is exemplified by many domestic species, as the hog, the hen, etc. Again, there are many low tribes of men who do not hunt, but live principally on roots, leaves, and berries. These are usually the very lowest tribes known, and may form a sort of link between the hunters and a still lower state. Indeed, it is claimed that on the Island of Borneo, as well as in the interior of Australia, there actually exist men who have no habitations, live on grass and nuts, climb trees like the orang-outang, lead solitary lives, possess no articulate language, and are hunted and shot by the savage but more developed natives like wild animals. Reports of similar races in the interior of Southern Africa have also been made, and, though needing scientific verification, are not probably wholly without foundation in fact (*supra*, p. 417).

Passing over the pre-industrial stage, and confining ourselves to the era of production, we find mankind struggling to increase the quantity of food which the vegetable world supplies. The first step in this direction was to determine what plants and what parts of these plants do by nature afford the required nourishment. This labor, although it does not belong to agriculture, does, nevertheless, belong to production. When cattle are turned into a pasture, they graze only upon those plants which are wholesome, and leave the rest. More probably they eat only such as are agreeable to their palates, and adaptation has brought it about that poisonous herbs are not generally agreeable. This may have been the case with man also, and in so far this species of selection constitutes no production. But this sense is at best a very rude and imperfect one. Many of the plants which do not agree with the palate may agree perfectly with the stomach. Many that present a noisome exterior may have concealed internal parts which are sweet and nourishing. Many which are inedible at one period of their growth may be edible at an earlier or a later period. Many whose visible portions are vapid or noxious, possess valuable subterranean portions. The cow disdains the green parts of the potato and the artichoke, but finds the tubers excellent after man has dug them up for her. And so he must do for himself, using a large amount of sagacity, and performing considerable labor.

This kind of selection and effort belongs to the productive class, and forms man's first experience in the production of vegetable food. From this he enters upon agriculture proper. Having found out what plants yield nutrition and in what parts of them this nutrition is located, he proceeds to lay special stress upon these, and seeks to make a larger amount of them grow. Here is called into play a still higher order of sagacity and a still greater effort of body. The noxious and useless plants must be destroyed that the nutritious and useful ones may thrive. The latter must be brought nearer together than they spontaneously grow, to render them easy of cultivation and more certain to fructify. The soil must be prepared by loosening and clearing of obstructions of all kinds. The seed must be carefully planted, the germ tenderly cared for, the growing plant watered and weeded, and the matured fruit harvested. All this is calculated to call forth the best faculties of the mind and afford the body ample exercise, well adapted to its healthy development. The certain results attending these labors served to inspire confidence and stimulate industry.

The fact should not be forgotten that labor is not the natural condition of man. The true power of these social forces can never be understood until we recognize that work is unnatural and irksome. The attempts which have been made to induce the North American Indians to follow agricultural pursuits are sufficient to indicate the difficulty of the transition from the non-industrial to the industrial state. It must have required a powerful motive to curb and steady all the wild and adventurous desires of the human heart and compose them to the monotony of toil.* One of the most important effects produced by the necessity which forced itself upon the human race of endeavoring to increase the

* The influence of slavery in disciplining mankind to uninterrupted labor has been frequently referred to, but I can not agree with Mr. Spencer ("Study of Sociology," p. 196) that without it this state of discipline is never reached. The constant spur of want is sufficient of itself to accomplish this, as is evidenced by non-slaveholding industrial societies.

natural supply of vegetable food, was the check which it placed upon the roving propensity, to which both the predatory and the pastoral states were favorable. The hunter must follow his game. To remain in one place would be to exhaust it of the very objects upon which he subsists. He must therefore frequently change his abiding-place, and the tendencies are strong to render his whole life a roving one.

The shepherd must always find pasturage for his flocks, and, although he need not be perpetually changing his location, still we find, as a matter of fact, that the pure pastoral shades off easily into the nomadic state.

It is quite otherwise with the agricultural state. This, instead of favoring migration, does not admit of it.

The importance of this fact in the industrial history of the race is not to be overlooked. From a moral point of view, it is immense. From an economical point of view, it is still greater. Civilization is the result of human labor, guided by thought. All labor to be useful must be continuous. It must be applied to a given object, and continued upon that object until the result is attained. This requires permanence of location. Change of place is inimical to it. All the attendant circumstances must go with it wherever it goes. Removal is, therefore, necessarily attended with costs which neutralize production. This being so necessary in all the multiplied forms of human industry, it was of incalculable value that at least one, and that the most important of the primary forms of producing food, should be calculated to discipline mankind to steady labor in one fixed and permanent location. Since all vegetable food must come from the soil, and since it must occupy a definite amount of area upon the earth, it soon became apparent that this area possessed a certain value. The soil became an object of possession. All value is the result of labor. The amount of labor bestowed upon the soil became a rude measure of its value. Its bare occupation was sufficient to assign a value to it. The multiplication of individuals rendered the recognition of that value an absolute necessity. Thus arose the great land interest, the most vital and important of all human interests. As a terrestrial being, the land is man's habitat, and from it must be drawn, whether directly or indirectly, his entire supply of subsistence. So vast and powerful has been this interest that even in history it has occasionally forced itself into view amid the detailed accounts of the ephemeral deeds of accidental rulers.

I need not here enter into the history of the soil, nor discuss those great agrarian questions which have absorbed the attention of the world from a time long anterior to the age of the Gracchi. It is enough to glance rapidly over this field and note the progress of the race in the production of subsistence from that source. The cultivation of the cereals and of vegetables of various kinds became at length a systematized industry. The land was parceled up into definite tracts, acknowledged as the property of each. The most successful modes of planting and sowing, of tilling and of harvesting, were learned from experience, and the entire system of agriculture was at length established.

But the production of vegetable food does not consist alone in the growth of nutritious plants and the harvesting of crops. As man became more intelligent he also grew more fastidious, and required more and more preparation of his food. His grain must be thrashed, then it must be ground, and, finally, it must be sifted and bolted. Nearly all the kinds of vegetables came to require some preparation before they were deemed suitable for food. And then they could not generally be eaten raw. Cooking, a further preparation, grew up with the rest, and was gradually reduced to a special art. All this required additional labor, and rewarded it with correspondingly improved food. The labor was more willingly bestowed, as it was learned how ample was this reward.

We thus see how vast must always have been the agricultural industry. During all those ages of which we read in history, contemporaneous with the kings, princes, and heroes, the warriors and armies which fill up the foreground, there must have been all the while going on this great vital movement of food production from the soil, without which these armies must have perished more ignominiously than did the host of Sennacherib. In fact, it was only in proportion as this production became greater than the consumption, thus setting free a certain number of men from the necessity of labor, that these superficial movements were made possible. The record of events which history makes is little more than an account of those mischiefs which are the proverbial product of idle hands.

Production of Animal Foods.—The consideration of the modes of production of animal foods, instead of taking us a step forward in man's career, carries us rather a remove further toward his origin. For, although, according to all the probabilities, he set out in his career as a pure vegetarian, still there is reason to believe that he departed from that course and maintained his existence by hunting and fishing before he entered upon an agricultural career. This opinion is verified by the actual condition of many savage races at the present time, the very lowest of which are more or less purely vegetarian, and the next almost or quite wholly carnivorous. This order of succession in the states of the race is in harmony with the theory of the gradual development of the intellectual powers. The pure vegetarian condition is the simplest, and calls out the least exercise of thought. The stationary character of vegetables renders them, in so far as nature alone provides them, easy of possession. It requires little sagacity or labor to gather berries, leaves, and nuts. The digging of roots is equally simple, though somewhat more laborious. But to hunt and ensnare wild beasts requires a certain amount of cunning and somewhat greater physical activity. Pastoral life taxes the mental powers still more severely. The next attempt at obtaining food from the vegetable world is through cultivation, which raises man a grade higher still in the scale of intelligence. The flesh-period, as it may be styled, is a sort of transition stage from one fruit-period to another.

Again, this theory of succession is in harmony with that of man's struggle for existence. The first cause of this struggle is increase of numbers. As long as he was a solitary being the vegetable world afforded him an ample supply without labor or skill. As his numbers increased, this source began to be exhausted, and the next most natural resort would be the animal world. Finding the antelope, the buffalo, the grouse, becoming scarce, he set about the task of accomplishing their domestication, in order to be able to keep up the supply. The use of milk and eggs, though incidental, became important, and added a new value to domesticated animals. It is not until all these sources threaten to fail that recourse is again had to the soil, but this time accompanied with skill and labor. Such is the theory of man's early industrial progress. In point of fact, these periods must have overlapped one another and been perpetually blended, somewhat as the paleontologist finds the forms of life in the theoretical periods of geology.

The hunting stage has left its unmistakable stamp upon the whole human race. Love of the chase, so universal in the most enlightened peoples, is regarded by many philosophers as the simple survival of those wild sentiments which were implanted in man in that remote and savage era of his existence before he learned the noble arts or acquired the steady habits of agricultural and industrial life. The production of animal food by hunting can not be called an industry, although entered upon with all the earnestness of the most serious business. That it is a species of labor, and often of the severest kind, can not be denied, but there is attached to it so much of pleasure and adventure that it scarcely warrants being dignified with the name of work.*

* It is doubtful whether any tribe or race subsists by hunting alone. In nearly all, the women perform other services, and often till the soil.

Still, it is a mode of production, and has proved a very important one for mankind. The fishing interest has never been renounced, and still constitutes a large and important industry, furnishing no insignificant part of the food of man. The pastoral life even when pure was of an industrial character, and proved a successful mode of supplying human wants. It is still pursued more or less exclusively in many parts of the world. The production of animal food, however, by the fattening of domesticated animals, is the second food-producing industry of the world. The importance of the labor of supplying the world with meat is only less than that of supplying it with bread.*

To obtain bread and meat—that is, to obtain food, to supply the cravings of the stomach, to satisfy the demands of the palate—these are the objects in whose accomplishment the greatest exertions have been made, the most extensive labor performed, and the grandest material results attained. The motive is none other than the preservation of existence. Although these results are secured indirectly and are never realized by the individual, they are always fully recognized by nature, whose primary end they are, and the great preservative force, irresistible and perpetual, is always adequate to the task it has to perform. I have endeavored to give a hasty sketch of its operations along the single line of supplying food to man. Let us now turn our attention to other wants.

Secondary Production.

The objects of production, in so far as they conduce to the preservation of life, are chiefly of three kinds, roughly described by the three terms, food, clothing, and shelter. Of these the most important product is food, and the labor required to obtain it has been called *primary production.*

* See a communication by the writer on the "Animal Population of the Globe," made to the Philosophical Society of Washington, October 23, 1880; "Bulletin," vol. iv, p. 27. The paper was published *in extenso* in the Chicago "Times" of December 18, 1880.

Having considered this mode of production somewhat in detail, we are now prepared to glance in a similar manner at the other mode, or *secondary production.* It is threefold: 1, the production of clothing; 2, of the means of shelter; and, 3, of implements, utensils, and other devices necessary to facilitate and render all production possible. It is convenient to embrace under this head the production of the means required to carry on all the processes which are accessory to production, such as commerce, exchange, etc., which industries themselves will be touched upon in another place. In short, we may take the designation of secondary, or auxiliary, production to comprehend the whole domain of practical art.

The production of food, though a means of existence, may be considered as an end, the ultimate object of all the activities excited by the preservative force. The objects required for the accomplishment of this end, the auxiliaries which the mind of man has devised and his labor created to assist him in securing it—these are the *means* which he has employed, and must rank secondary to the primary end of human effort.

The production of clothing and habitations, though primary, in the sense of being directly essential to the preservation of life, are secondary in another sense. Food is a natural and inherent necessity, which no circumstances or surrounding conditions could obviate or affect. Clothing and shelter are but contingent necessities. It is surrounding circumstances, atmospheric conditions, and modes of life which determine whether they are necessary or not. The theory of man's origin, which makes his present condition a progressive development from a less perfect form of existence, is certain to carry him back, sooner or later, to a state in which he could have possessed neither artificial covering nor artificial dwellings. If it be true that the human species originated within the tropics, or at a period of the earth's geological history when the climate where he first appeared was tropical in its character, he might have existed there for an indefinite period without these commodities. The savage tribes now inhabiting the tropics are found to be more or less in a state of nudity, and what clothing they possess is often chosen without the least view to comfort, but rather with a view to ornament or from the sense of modesty. Just as frequently they are without habitations, or with little more in the place of them than some of the beasts of the forest possess.

In the sense of contingency, therefore, clothing and shelter may be safely called secondary products of human labor and human art, although, in the condition to which man has now attained, and in which all recorded history has found him, they are as much necessities as food itself.

It is the objects of human *art*, then, of which we have now to speak. The personal power of man to obtain the means of subsistence is exceedingly limited. His physical form is poorly adapted to the performance of those acts by which alone the resources of the earth are to be increased. With neither the wings of the eagle nor the fleetness of the hound, he finds himself soon outstripped by the grouse and the hare. With neither gills nor fins, he is readily evaded by the inhabitants of the water. Destitute of appropriate weapons of offense, he finds himself no match for many of the animals which he would gladly kill for food. Unprovided with claws for digging in the ground, he can not burrow for safety either from his enemies or from the elements. Neither can he long till the soil with his fingers and toes. Unfitted, as he is, for periodical migration for the purpose of escaping extremes of temperature, and yet frequently compelled to change his habitat in consequence of the rapid increase in his numbers which soon renders food scarce in any one locality, he finds himself in danger of being dashed against Scylla whenever he seeks to avoid Charybdis. With all these limitations upon his existence and progress, there remained but one hope for him, and this lay through *invention.*

The devices and stratagems by which he was enabled to circumvent the less sagacious forms of life, and the foresight and calculation which taught him how to multiply the growth and abundance of nutritive vegetables, were of no avail beyond a certain limit unless supplemented and assisted by a still higher order of mental activity, by a practical comprehension of the inert laws of physics and mechanics, and the skillful elaboration of material objects into forms adapted to aid, accelerate, intensify, and focalize the natural forces which were operating in the direction of producing his means of subsistence. The form of mental exertion, the species of cunning, which he had manifested in the primary modes of production, were superficial and general. To make them permanently successful, they required to be seconded by more profound and more specific forms of psychic power and intellectual energy.

Arts practiced in obtaining Animal Food.—The greatest paradox in nature is the fact that the most highly organized forms of matter and the most complex forms of truth are the earliest to attract the attention and elicit the consideration of man. As religion, ethics, and metaphysics had their teachers and their followers long before physics, chemistry, or geology, so the phenomena presented by the organic world enlisted the interest and absorbed the activities of man long before those presented by the inorganic world. And though the explanation of this anomaly is to be sought in the more practical, and especially the more obtrusive, nature of these complex organized and self-acting objects, still in the former, as well as in the latter case cited, the superficiality and uncertainty of every thing done to affect those things concerning which man knew so little, rendered such efforts futile, or at best transitory in their results, and sooner or later suggested and compelled the return to a more humble plane of action, and the effort to obtain a better understanding of the objects, phenomena, and laws with which he had to do. It is no wonder, then, that the first objects toward which he turned for supplies of subsistence when he found the spontaneous products of nature failing him should have been the most highly organized beings which nature had evolved—the animal kingdom. Though in fact an illusory resource for him, it was the most obvious one within his reach. The locomotive powers of animals alone more than doubled the frequency and prominence with which these objects were thrust upon his attention, while the agreeableness of the taste of flesh and the nourishment afforded by it rendered it at once a strong attraction. But its obtrusiveness soon proved deceptive. The very locomotive powers which brought the animal world so frequently and manifestly into man's view availed to keep the greater part of it out of his reach. The few animals which he could obtain by means of the appliances with which nature had provided him were soon exhausted, and the choice left him of migrating perpetually or devising other means than these for securing that portion which lay beyond his reach. Even these, of course, must soon be exhausted in their turn, and all resort to the animal creation precluded, unless the principle of domestication could be successfully applied. But this, and the benefits to be drawn from it, required still higher arts and still more of that fundamental knowledge of which we have spoken. It is by the vigorous, careful, and successful application of all these arts that the flesh and other products of animals have been supplied to man.

Arts practiced in obtaining Vegetable Food.—The attempt to till the soil without tools must have had a still narrower limitation. In order to effect any extensive increase in the amount of vegetable food produced from the soil, some means of preparing it must be devised, some rude agricultural implements invented. And success in agriculture has always been and still is more or less proportionate to the serviceableness of the implements employed. The greatness of this necessity for tools in agriculture may be conceived when we remember that the greater part of the globe is originally found covered with forests. Naked hands are powerless to remove these, and the ax, or some substitute for it, is the first demand. After this follow in their own good time all the other agricultural implements, from the hoe to the steam-plow, and from the sickle to the reaper.

Art displayed in the Preparation of Food.—In addition to the instruments and tools required for the mere production of foods, there must be mentioned also those employed in their preparation. Cooking-utensils have played almost as important a part as the implements of agriculture and of the chase, as is evidenced by the position that pottery occupies in archæology.

Art required in providing Clothing and Shelter.—Under the head of instruments—the physical aids and means of production—are to be included, also, such as are needed in the manufacture of clothing and habitations, which two remaining secondary objects of production we are about to consider.

Nature and Sociologic Importance of Invention.—Looking now at the nature and uses of these various instruments, we see that their invention and manufacture must have required an immense concentration of thought and of labor. The inventor of a useful instrument is the best illustration of a final cause. With the end distinctly in view but beyond his reach, he sits down and evolves from his knowledge of physical laws an *indirect method* of accomplishing it. Unable to perform an act immediately, he reasons out a plan of performing it mediately. By a train of logical calculation, from premises obtained by experience and observation, he determines a mode of taking advantage of blind mechanical forces and directing them into such channels as will accomplish the end in view. This method may be illustrated by the simplest of the mechanical laws, that made use of in the lever and fulcrum. The advantage which man is able to take over nature by an adjustment of appliances is the principle or *nexus* which connects mind with matter, and permits the former to manifest itself through the latter as a force. And the same illustration shows us what a mighty force it is, and explains the vast labors which have resulted from its exercise. Every instrument, utensil, implement, or appliance is, and of necessity must be, constructed on this general principle. To be a means of accomplishing an end, it must consist in a device for directing natural forces. It is improper to ascribe to it the power of increasing these forces, since force is not capable of increase or diminution. The apparent increase is only the concentration of various forces, previously scattered and useless, upon a single point which it is desired to move. Every such instrument, therefore, presupposes a knowledge, on the part of the inventor, of the mechanical laws which underlie the phenomena to be produced. This knowledge is not innate. It does not come without effort. It is only acquired by thought, reflection, or abstract reasoning. It is the result of hard intellectual labor.

The manufacture of instruments, which in the infancy of art must have been combined more or less with their invention, required a species of mental power which is called *ingenuity*. Ingenuity is the ability to perceive the relations of parts of a mechanism before they are created, and to adapt them to the end proposed. Every part of the instrument must be in harmony with every other part, and adapted to aid in accomplishing the given object. All this requires a degree of intelligence considerably above what we have reason to suppose the most sagacious of animals to possess. And it must all be accomplished by reason, since the production of artificial instruments as means to ends seems to be above the range of instinct.

PRODUCTION OF ARTIFICIAL APPLIANCES.

When we reflect how powerless man must have been without some such artificial means, how every thing he produces is done by their aid and can not be done without it, and what an immense number and variety of these must be in constant use in all the departments of industry, we can form some idea of the proportion of human labor which must have always been directed to the manufacture of the mere instruments or auxiliaries of production. The exact proportion is to be determined by the age and country, and by the prevailing forms of production, but in all cases it must be very great. If we take our present industrial condition as an example, we find immense establishments devoted wholly to this kind of manufacture. The manufacture of fire-arms (not to be employed in war), of fishing-tackle, of agricultural implements, of cutlery, of cooking-utensils, of pottery, crockery, dairy and laundry ware, of machinery of all kinds, and of tools required in building, require in all probability a greater amount of labor than is bestowed upon all kinds of direct production except that of agriculture. And this has doubtless always been true. Always inventing, always making instruments of production, and always employing them in production itself, the human race has ever been a busy swarm, constantly pursuing the objects of existence under the unremitting spur of the life-preserving forces.

Appliances for Protection against Climate.—The class of products just considered is auxiliary to direct production. In that sense they have been called secondary. The class we are now to consider, though itself a direct product and immediately essential to man's existence, is nevertheless secondary to the original and inevitable necessity, food, inasmuch as it is only a contingent necessity dependent upon surrounding circumstances. These circumstances, however, though liable to change or to disappear entirely, are such as are beyond the sphere of human control. They are natural phenomena, viz., temperature and meteorological processes, *i. e.*, climate, and, though at the present time regular within certain limits, they may, for aught we know, undergo a complete alteration at some future time in all parts of the globe. There is every reason to believe that the earth has already undergone several such changes since the appearance of life upon it, one of which, the last glacial epoch, is now believed to have taken place entirely within the age of man. Still, within historic times certainly, and probably within the greater part of the human era, there has been no perceptible change in the general thermal and meteorological conditions of the globe. The necessity for clothing and shelter originated, in all probability, in the migrations of men from tropical to temperate and frigid latitudes. Their rapid increase and hostile nature made such migrations necessary, and these modes of protection had to be resorted to in order to secure them from the fate of extinction, which usually attends species of animals when they thus overstep their natural boundaries.

Art of making Fire.—Before entering upon the separate consideration of the two great protective products, clothing and shelter, it may not be too great a digression to inquire into the origin of an art which, while it has done much to accomplish the same general object, must have gone hand in hand with them chronologically, if it did not precede them, viz., that of making fire.

No animal of which we have any knowledge possesses either the knowledge or the instinct of making fire, while all human races, with the exception, perhaps, of a few of the lowest savage tribes, possess this art.* Nearly all living beings must be more or less familiar with the appearance of fire, since, where man does not light it and permit it to ravage the country, there is always the possibility of spontaneous ignition produced by accidental chemical unions.

There are various ways in which so intelligent a being as man might have learned the art of kindling fires. By watching the processes of ignition in spontaneous fires, he would

* "L'origine du feu," par N. Joly, "Revue Scientifique," 22 jan., 1876, p. 73; Dr. John W. Draper, in "History of the Conflict between Religion and Science," p. 197; Darwin, "Descent of Man," vol. i, p. 132; Tylor, "Researches into the Early History of Mankind," chapter ix.

soon learn to transfer fire from one place to another, and apply it to substances which required more time in their consumption and evolved more heat. The influence of the wind upon embers would suggest the possibility of converting a glow into a blaze. The difference in the degree of facility with which different substances thus take fire would soon set him at work to find the substance most easily ignited, and would result in the production of various kinds of tinder. The very common phenomenon of striking fire between stones or metals would suggest the identity of this spark with those which fly from fire, and lead to the attempt to kindle tinder by means of such sparks artificially and purposely produced. The best substances for emitting sparks would be carefully sought, and the discovery of the superiority of flint would be made. It is not impossible that the phenomenon of heat produced by friction, necessarily so often observed, might have led to the discovery of this method of securing fire. I submit this as at least a rational explanation of what might have been the genesis of this most valuable art. The steps in the process are all the result of close reasoning, and must have required a degree of sagacity far in excess of any thing manifested by the brute creation. It is said that monkeys will warm themselves by the fires which travelers leave, but have not even the sagacity to lay on additional fuel which has been brought there for the purpose, and allow the fire to go out. And yet the monkey is one of the most intelligent of all animals, and possesses, moreover, a physical structure adapted to handling fagots. Before man could avail himself of the blessings of fire, therefore, he must have reached a stage of development intellectually far above the present state of the Primates (*supra*, p. 438). Yet the spur of necessity and the appreciation of the immense value of fire must have screwed up his inventive powers to the highest pitch of tension, and wrenched the utmost of valuable information upon the subject from every object which presented itself to his consideration. Once out of the tropics, artificial heat became a prime necessity, and must be obtained. The value of fire in the preparation of food, too, is not to be overlooked. We hear of cooking eggs in the sands of the desert, but we may assume with safety that practically there could have been no cooking until the art of building fires had been invented.

Once learned, it can not be said to have elicited a very large proportion of human labor, although the improvements which have been constantly made in the methods of kindling fires, from the flint and tinder or friction of two pieces of wood to the lucifer-match and the scentless parlor-match, have constituted a distinct civilizing agency, and made their manufacture quite an industry, while the various devices for economizing heat, from the open camp-fire to the most elaborate furnace or hot water or steam-heating apparatus, form a very important and extensive one.

PRODUCTION OF CLOTHING AND SHELTER.

Having considered the production of food and the production of instruments of labor, there remains to be considered the production of clothing and shelter. The object of both is protection from the weather. The former is particularly adapted to protect against temperature, the latter against storms. Each, however, performs both these functions besides other very important ones. Clothing affords some of the advantages of an armor, and a house constitutes a species of fortress. "Every man's house is his castle," is a maxim of law which has grown out of the real uses to which houses were put in feudal times. Inclosed habitations produce another very important effect upon society. They serve to segregate families, and conceal from the general public the minor acts of individuals. Few have ever reflected upon the extent of this influence. In the natural state, without places to retire to, and where all are herded together in such a manner that all the acts of each are exposed to the gaze of all, none of the finer sentiments were afforded an opportunity for development. Only the coarsest forms of existence could appear, and the play of passions must perpetually be seen. All this is wholly incompatible with refinement; but with this disadvantage it possessed the advantage of precluding much of the deception and pretense which inclosed habitations render possible. Every man must stand forth as he is, and be judged according to his real character.

A still more important derivative effect is produced by clothing. While it does not altogether conceal the individual from view or render his form indistinguishable, it does conceal the person of the wearer at all the parts where it is worn, and this species of concealment has exerted an immense moral influence upon society. When treating of the reproductive forces, I shall attempt the genesis of what we call modesty, and shall take that occasion to introduce the subject of clothing as a factor in the discussion (see *infra*, p. 632). For the present I shall confine myself to the products of the preservative forces, and restrict the object and influence of both clothing and shelter to their original functions as protectors of human life.

The art of making fire was an important step, but it proved quite insufficient to protect man from all the rigors of a cold climate. Before migration to such climates could be made successful, before the pioneer colonists of cold countries could survive and establish a permanent foot-hold, the other great arts of protection from the weather, the art of making clothing and the art of making inclosed habitations, must have been discovered and universally practiced.

Clothing.—The first clothing may have consisted of the skins of wild animals wrapped around the body as blankets. Various efforts to adapt them more closely to the form of the body, so as to give free play to the limbs, met with better and better success, until at length something like commodious garments were devised and worn. The discovery of the adaptability of animal and vegetable fibers to the manufacture of clothing, and of the art of spinning them into yarn and weaving them into a convenient fabric, must have been made at a much later epoch in the history of clothing, yet the progress from the loose skin mantle to the woolen tunic is very obscure. Certain it is that the use of hair and wool in the manufacture of clothing antedates by far that of flax or cotton. Still both these, and particularly the former, have had a very ancient origin.

Nearly all human clothing, not composed of the skins of animals, is, and always has been, derived from four natural sources, two of which are vegetable and two animal. These are flax and cotton, wool and silk.

These four great natural resources seem to be inexhaustible, since they all belong to the organic creation, and may be reproduced *ad libitum*. But the discovery of their adaptability to human wants was, doubtless, as slow as it was important. The passage from the skin of animals to a fabric composed of the wool by which it was covered must have suggested itself at an early day, but the necessary means of reducing this wool to the proper state for clothing were the result only of protracted study. This study must have been both analytic and synthetic. The fibers of the wool could not be made to lie together and adhere to form a useful fabric. They must be thoroughly changed in their nature to render them adhesive. An instrument for carding had to be first devised, then a machine for spinning, and finally a device for weaving, before any thing like cloth could be elaborated from wool. All this was not too much, however, for the fertile brain of man, and at least one great source of clothing was thus early discovered.

The resemblance of cotton to wool might easily have led to the discovery of the value of this plant, and the passage from cotton to flax might with equal facility have been made. The use of silk,* too, might have arisen in a like manner. These are, however, but vague fancies, and are probably mostly if not entirely unsupported by fact. We only know that from

* Cf. Bacon, "Novum Organum," lib. i, Aph. cix.

the earliest historic times each of these fibers has been in use as material for clothing. None of them, however, appear to have been universal, unless it be the use of wool. Egypt seems to have enjoyed the principal monopoly of flax, India of cotton, and China of silk. Indeed, with regard to silk, it is probable that its introduction was never effected in ancient times in any country except the last named. With regard to the manufacture of cloth, we possess unmistakable evidence that the art was known and extensively practiced at very remote prehistoric periods. The appearance of the distaff upon the most ancient monuments of Egypt shows that it must have constituted an important industry in ancient Egyptian civilization, and it is supposed that the textile fabric upon which it was employed was linen. This is substantiated by the discovery that the mummies were wrapped in a linen shroud, enough of which has survived to reveal its character. In India, Assyria, and Persia, the most ancient literary productions make mention of the loom as an emblem of human labor, and it is probable that in India, which has been thought to be the "cradle of the race," the art of spinning and weaving wool, flax, and cotton had been known and applied for ages anterior to the "Vedas," the oldest of human books. The Chinese claim that the cultivation, and of course the manufacture, of silk has been going on for a period of forty-five centuries.*

The principal instruments employed in the manufacture of cloth are the card, the distaff, the spinning-wheel, the reel, and the loom. The early forms of all these were exceedingly simple compared with the machinery now employed for the performance of these functions. Yet even these rude ma-

* It is worthy of note that copper utensils discovered in some of the mounds of the Mississippi Valley exhibit fine indentations which are regarded as demonstrating with certainty that when placed there they were closely wrapped with some kind of woven cloth, which, though it has entirely disappeared, has left a permanent stamp of its threads upon the copper. ("Bulletin of the Philosophical Society of Washington," vol. ii, p. 185.) The mound-builder race are certainly prehistoric, whatever may have been the date of their sojourn in this country.

chines were no idle tax upon the intellect of primitive man. But necessity, then as ever the mother of invention, accomplished their contrivance, and gave to the race another hold upon existence. It fortified it against the destroying power of low temperatures, and enabled man to wrap himself in warm and thick woven garments, and to go forth in defiance of the tempest in search of food. And thus another triumph was gained in the struggle for existence.

Shelter.—To surmount the obstacles presented by climate but one thing more was required—a house. The heat evolved by the combustion of wood was wasted upon the air, and radiated into space without affording man a tithe of the benefit which might be drawn from it. Clothing might enable him to preserve his natural animal heat while actively engaged in his daily pursuits, but it must fail when he was at rest or asleep. It might protect him from the cold and the wind, but it could never sufficiently ward off the rain or the snow. A dwelling-place became, therefore, a prime necessity. The inventive powers required to be called into exercise for this purpose were less than in the case of clothing. The materials for constructing the means of shelter from the storm were more apparent and abundant, and the processes required to be gone through to secure the realization of the object were far less complicated and obscure. The instruments and appliances, too, which must be employed were of a far simpler character. A cave hollowed out of the side of a hill, a structure of sods with a straw-thatched roof, a cabin of logs chinked in with mud—such are some of the primitive forms of human habitations. But these admit of almost infinite improvement. The capacity may be enlarged. The interior may be partitioned off into convenient apartments. The material may be improved, the clay made into regular form and dried in the sun (adobes), or baked in a kiln (bricks), the logs hewn into square timbers or sawn into thin boards and neatly fastened together. But each of these improvements involves a train of consequences and prerequisites. The manufacture of bricks is a special industry. It requires a corps of skilled artisans to lay them up safely and compactly into walls. Mortar * composed of lime and sand takes the place of clay. Lime is obtained by burning limestone (carbonate of lime) in a kiln, and slacking the same for use. Here is another new industry. The hewing of timbers is a skilled occupation. If they are sawn into boards, the process is immensely complicated. Saws must be invented. And to make any progress with so large a work other powers than human must be employed. For this purpose that of water is usually first resorted to. A mill must be constructed with all its machinery. The use of boards in building requires nails to hold them. This alone would involve the mining of iron and its manufacture into nails. And thus step by step the log-cabin is transformed into the spacious and commodious house. But to architecture there is no limit, and, under the form of a fine art, it reaches on upward into castles, cathedrals, and coliseums.

An inclosed structure is a symbol of civilization. An artificial dwelling-place is one of the chief marks which separate man from the brute. The great distinguishing feature of the landscape of inhabited regions is the buildings with which it is covered and adorned. In cities little else attracts the eye. Every-where where man has been are to be seen houses. The whole earth is dotted and decked with the habitations of men. How immense, then, must have been the productive industry directed to the object of sheltering the human race!

GENERAL REMARKS ON PRODUCTION.

I have thus hastily passed in review the chief objects and modes of production. I have found it convenient to divide

* It seems that none of the native races of America prior to European discovery understood the art of manufacturing mortar from lime and sand or of burning quick-lime in kilns. (See Lewis H. Morgan's "Houses and House-Life of the North American Aborigines," "Contributions to North American Ethnology," vol. iv, p. 177.)

them into two general classes, and to speak of primary, direct, or original, and secondary, indirect, or derivative production. The former embraces food, the prime object of the preservative forces. The latter embraces clothing and shelter, *i. e.*, protection against climate, and instruments, or the media through which intelligence gains access to and advantage over natural forces and materials. The production of these objects is the original and natural mode of acquisition. Whatever an individual desires, it is his first impulse to create or produce it. Objects which are already in the form required to be enjoyed do not constitute products, unless the effort made to obtain them renders them more enjoyable. All products are the result of both thought and labor. Yet, not all things which have cost thought and labor are necessarily products, since much thought and labor is expended in obtaining the possessions of others. And thus, as we shall see, far too much mental and physical energy is often bestowed upon an object. All the true value which is ever conferred upon an object is conferred by the labor required to produce it. I refer only to absolute value; its relative value may vary from many minor causes, the chief of which is distribution. It is a common remark of statesmen and economists that all value is ultimately reducible to labor, and that labor is the only true measure of value. While this may be sufficiently true for political or commercial purposes, it should be taken with one qualification, which is more important in some objects than in others. This is the net value of the raw material in its original position. In most vegetable products this is zero, since the wild plants are valueless; but in manufactures of gold, silver, and the precious stones it is often their chief value. It is not the labor expended upon the Kohinoor, nor yet that required to extract it from the earth, which gives it its value. Its value is intrinsic in the strictest sense. Still, it must be confessed that in our day almost every thing of value is artificial. I speak, of course, of commercial value. The soil presents something of an anomaly in this respect. It should be classed with those things which have no commercial value, but are simply *conditions* rather than *means* of existence. It would be so regarded but for a single quality which it possesses, which the other objects of that class do not; viz., *local permanence*—the quality of being immovable. It is in consequence of this quality that land is capable of being staked off and appropriated, that it is capable of being made property. The very staking off and defending, the mere act of taking possession, is, however, a kind of labor, and may be regarded as the first act in producing its value. But although the principle of recognizing the title of mere occupation must always have its limit, yet all the fine-drawn arts of securing a legal and an artificial title to the soil must eventually and occasionally yield to the great title of nature by which they were first gained—that derived from forcible seizure and retention, or the right of occupancy.

I have spoken of production as if its only objects were those which are adapted to the chief natural object of preserving life. While I do not ignore the manifold human desires which must be gratified by the objects of productive labor and yet do not directly contribute to the preservation of the physical existence, I have, nevertheless, sought to assign to this function the widest signification of which it is capable. For it is not only necessary to maintain a bare existence, but it is essential to the preservation of the race that its means of subsistence be ample and abundant. An individual may subsist for a time on a scanty regimen, but he will subsist for a longer time on a better one. Any thing which in the least contributes to render life more secure upon the whole belongs to this class.* And when the full force of this truth is recognized it will be seen that we must transfer to the list of necessaries very many objects which are now ordinarily regarded as luxuries. The term "necessaries," in a philosophical sense, should be construed

* Herbert Spencer, "Data of Ethics," p. 14.

as liberally as it is in a legal sense. Every thing which exerts the least influence in improving the physical condition of man is a necessity. The development of new desires and the gratification of old ones are useful as making existence more desirable, and the effort to preserve it more persistent and successful. It would be no stretch of definition to bring the fine arts into this class.

Every thing which serves to increase the fund of human knowledge is useful in the general direction of preserving life, since the mind is the regulative power which alone has brought the species through the several ordeals which first or last prove fatal to all other species. There is no estimating the remote but often immense influence of some of the most occult and apparently useless facts. Let him who doubts this study the causes of the extinction of species as taught by Darwin.* The definition heretofore given of the term "practical," confining it to such acts as conduce to the accomplishment of those ends which have been designated the "objects of nature," the most important of which is the preservation of existence, receives, therefore, under this view an additional expansion, and the circle of the practical encroaches more and more upon that of the liberal and æsthetic in all departments of human life. Nor does this prospect alarm any person who is capable of taking a comprehensive view of man and nature, while those who rise to the height of recognizing in happiness the ultimate end of all action and all existence, find no reason to be shocked at the proposition to call every thing practical which contributes aught toward the accomplishment of that end.

That there are grades of utility, however, is by no means to be denied, and they may not improperly be ranged under two quite distinct classes, in one of which may be placed every thing which is a *sine qua non* of existence, and in the other the auxiliary and indirectly beneficial objects.

* "Journal of Researches, etc.," pp. 146, 174, 176; "Origin of Species," pp. 79, 301; Haeckel, "Schöpfungsgeschichte," S. 231.

Under this classification every object which contributes to the happiness of man must fall into one of the three following groups: 1. Objects essential to the maintenance of physical life. 2. Objects conducing to the general welfare, and ultimately promotive of the longevity and perpetuity of the race. 3. Objects whose only apparent effect is to increase the sum of human happiness, and whose influence upon the maintenance of life, either presently or remotely, is of a moral nature, and incapable of explanation upon any obvious principles.

All these classes of objects consist chiefly of the products of human ingenuity and labor, and before they can be appropriated or enjoyed must first be produced. The busy swarm engaged in this labor constitute the great indispensable class of mankind called producers, a brief sketch of whom, chiefly through their products, I have attempted to trace.

Accessories to Production.

Let us next consider, and with a degree of brevity proportionate to the inferior importance of the subject, the second great class of laborers in the industrial world, viz., the *accessories to production.* That must have been a primitive estate indeed, if it ever existed, when mankind knew no means of exchange of products—when the producer and the consumer were always united in one and the same individual, and each man enjoyed the fruits of his own labor and no other. Such a condition could only be the concomitant and consequence of a more or less absolutely solitary state. It could not exist in any thing like a social state, unless it were the mere gregarious condition of animals; and there is no evidence that such was ever man's condition.

DISTRIBUTION.

Some means of *distribution*, however rude, must have existed at a period coeval with the earliest forms of production. That the offices of both producer and distributor were often, and at certain early stages of society usually, combined in one person, may be true, as they frequently still are; but, as the objects of production multiplied and became more perfect, they continued to demand more and more the special and exclusive attention of the producer, and each producer confined himself more and more to the production of one special object, or eventually to some one part of one object. And, while his product could only contribute in one, it may be insignificant, respect to the gratification of one desire, he was nevertheless endowed, like all other men, with all the desires of humanity, and in need of all the objects required for the subsistence of man. As his own product can not supply all these wants, he must receive his supplies from others, and either directly or indirectly out of the products of others. But, as, in the present social state, all or nearly all other producers are engaged in the same manner as himself, they can not afford the time for distributing their productions, and must intrust this task to a distinct industrial class. These "middle-men," standing between the producer and the consumer, and charged with the distribution of the products of human industry, constitute a very large and influential element in society, and, under the designation of accessories to production, seem to deserve a special consideration in this review of the principal modes of human acquisition.

The term *distribution* may be taken in a generic sense to embrace all the processes which a product must undergo in its passage from the hands of the producer to those of the consumer, and will thus include not only transportation and exchange, but all those concomitant negotiations which are involved in these dispositions. The subject naturally divides itself, therefore, into three parts: 1, that which relates to the transportation of products; 2, that which relates to the exchange of products; and, 3, that which relates to the business that grows out of these industries. The first of these industries constitutes what is called *commerce;* the second embraces most *mercantile business;* and the third is little else than what is comprised under the general term *finance.* The first two relate to, and have to do with, the products themselves—with merchandise; the third deals chiefly with the medium of exchange, or money.

Transportation.—As a mode of acquisition this class of labor has assumed a prominent place in the history of society. The transportation of various commodities from one place to another is, next to their production, perhaps the most important of human enterprises. It involves the history of the various interesting voyages after articles not found in the countries from which they were made. The voyages which were so successfully conducted by the Phœnicians to all points on the Mediterranean, to the shores of the Baltic, and even to remote points in Africa and Asia, in search of various metals, of spices, and other vegetable and animal products, possess an interest for the student of sociology only equaled by their value as keys to the history and character of the human race. In the reign of King Neku II of Egypt, six centuries before the Christian era, a Phœnician voyage is supposed to have been made under his auspices around the entire continent of Africa; and, according to Aristotle, Strabo, and Pliny, an attempt was made by Rameses the Great to cut a canal through the Isthmus of Suez for the purpose of transporting the copper, then so much more important comparatively than now, from certain parts of Arabia, where it was found, to the Egyptian metropolis. The Phœnicians also carried on an extensive commerce in bringing tin from the coasts of India, from the mountains of Spain, from the Scilly Islands (formerly called the Tin Islands), and from the shores of Denmark. Their means of transportation were not confined to ships, the trade being also extensively carried on overland in caravans which undertook a general exchange of commodities among the nations of Gaul and Southern Europe. Not less extensive, if less useful, was the celebrated amber trade, whose important source was the west Cimbrian coasts, but which was also found in large quantities buried under the soil of Scythia and far up along the Ural Mountains. Adventures in search of gold, silver, and precious stones have filled history with romance, and led to the most important geographical discoveries. Although the precise locality of the ancient Ophir and Supara is not definitely known to the present age, it is certain that the traffic between the ancients of the Mediterranean coasts and these countries was on a grand scale and long protracted. But perhaps no trade has surpassed that which had for its object to supply the Western world with the spices, gums, and incenses of the East Indies. During the Phœnician ascendency and Grecian glory, this extensive trade was conducted across the country where the splendid "Palmyra of the Desert" formed one of the chief stopping-places for the caravans.

It is thus that the history of mankind is filled with the most interesting adventures, each of which possesses an economic as well as an historical significance. For the prime motive of all these activities has ever been the hope of gain —the love of acquisition. Much as the mere love of adventure may have spurred certain individuals on to make long expeditions into new and unknown lands, this motive lacks the promise of substantial reward which alone could render these expeditions successful. And, therefore, although the charm of romance and adventure may have risen in the distance, and eclipsed, from tradition and from story, the prosy facts of necessity and the sordid motives of gain, it is always safe to assume that these must have existed, and placed their seal of success upon all such enterprises.

The Argonauts were doubtless in search of something more than a "golden fleece," and the "labors" of Hercules may be taken to represent a far more practical phase of human life than the slaying of monsters or the bringing of apples from the Western Garden. All these legends and traditions are either embellished accounts or allegorical representations of human activities, at the foundation of which has lain the desire for acquisition—the pleasure of possession. They are histories of commercial events, painted with the pencil of the imagination.

But all this commerce, this traffic in useful commodities, these nautical expeditions, these overland caravans, had been going on for ages before the beginning of history, before the discovery of any means of written communication. Their universal necessity rendered them comparatively secure against the influences of war and political vicissitude. With the expansion of productive industries, and the multiplication of the products both of growth and manufacture, the peopling of new and distant continents, and the general increase in the wealth and improvement in the condition of mankind, the labor of transportation assumed very much enlarged proportions, and those things which at first formed the chief objects of commerce became reduced to a relatively insignificant proportion of it.

The closer division of labor, which is the necessary result of more perfect social organization, rendered the work of transporting all products a special industry, and gave birth to that wonderful internal commerce which we now behold, while it raised foreign commerce from the condition described, of half-adventurous expeditions and overland caravans, to one in which regular lines of steam and sailing vessels perpetually plow all the seas, and exchange on a grand scale the natural and artificial products of all parts of the globe, giving employment to millions of human beings.

It would be improper, in a work seeking the causes and conditions of social progress, to mention the subject of commerce without pointing out some of its indirect moral as well as its direct economic effects. The chief indirect influence which it has exerted has been in the extension of man's knowledge of the physical geography of the earth. It has been the most effectual agency that has operated in this direction. While it is probable that the mere increase of numbers would have eventually accomplished the peopling of the whole world; while, if the doctrine of the common origin of all men be true, it must long ago, and before the age of either history or commerce, have virtually done this; still it is mainly through commerce, through these expeditions, voyages, and wealth-seeking adventures, that the more civilized parts of the world have been made acquainted with the existence of other parts and their less civilized inhabitants. Nothing did so much to inform the ancients of the physical and ethnological condition of Europe, Asia, and Africa as these voyages in search of tin, copper, amber, spices, gold, and silver. And, when the new era of oceanic discoveries began, it was the same motive, guided by increased knowledge, which led Columbus and his contemporaries to the Western hemisphere. The immortal Genoese, with his belief in the rotundity of the earth, promised Ferdinand and Isabella that he would reach the rich land of spices by a westward voyage, and when the welcome coast of San Salvador rose on his view he was certain that he was beholding the eastern shores of India! Nor was he undeceived after landing, nor after twice more repeating his voyage across the Atlantic, but to the last moment of his life maintained that he had discovered a route by the west to the South seas. There is little doubt that the prior settlement of America by Europeans in the eleventh century was likewise the result of commercial enterprise, since the Northmen were famous for voyages of traffic. So, too, in looking back, we are apt to forget that the brilliant discoveries of the Cabots, the Cortereals, of Hudson, Davis, Baffin, and Ross, in North America, were made in attempting to find a northwest passage to the East Indies, were purely commercial in their character, and had as their motive the universal love of gain.

Besides the knowledge which the voyages of these men and their co-laborers brought to light respecting the Arctic regions, still more important polar discoveries were the result of the notorious efforts so persistently made, throughout a period of a century and a quarter, to establish a northeast passage to the same country of wealth and bounty. From the English expedition of Willoughby and Chancelor, in 1553, to the Dutch expedition of Wood, no less than nine distinct expeditions were fitted out and sent on this perilous undertaking. But, although all these attempts proved wholly fruitless, and neither a northeast nor a northwest passage to the Indies has ever yet been effected,* who shall say that all the labor and suffering which these expeditions occasioned have not been amply rewarded in the vast geographical and other scientific discoveries to which they have led?

Neither ought I to omit mention of the extensive contributions which commerce has yielded to ethnology and anthropology, not to speak of other sciences which have been enabled to extend themselves along its lines of march. The intercourse with foreign peoples, with strange and peculiar races, has exerted an influence upon all thus brought in contact which it would be impossible adequately to measure. That universal blending and intercommunication of ideas, manners, and customs, which traffic produces among the most widely different peoples, all of which must possess the one common quality and bond of unity, the love of gain, exerts an influence which can not but be liberalizing, civilizing, and elevating. The intercourse of nation with nation, of man with man, of thought with thought, has, by a law of mind, a distinct tendency to the evolution of new ideas, the sharpening of wits, and the increase of intelligence. Commerce, as the vehicle of human experience, is a great civilizing agency.

Exchange.—The second class of accessories to production embraces those who are engaged in the mere exchange proper of commodities. They are the mercantile class, in a restricted sense. As producers become too busy with their special work to find it profitable or convenient to engage in the exchange of their productions, they naturally intrust this

* I have allowed this passage to stand, written, as was the whole chapter, in 1873 and 1874, or six years before the Nordenskjöld expedition.

labor to others. The consumer is too far away, and therefore there must be a transporter, but it is found inconvenient to transport direct from the producer to the consumer, and hence the plan is adopted of transporting from various producers to one exchanger, from whom the consumer purchases. Sometimes a second transportation takes place, viz., from the exchanger to the consumer, which may be done by either the one or the other, or by a second transporter; but usually the place of exchange is near the place of consumption, though it may be remote from the place of production. Very frequently there are two or several exchangers, the first of whom usually exchanges products in gross or at wholesale. The existence of great commercial entrepôts renders this necessary. Toward these, as the hearts of the system, all the products of the world are conveyed by a sort of venous circulation, and from them, by a corresponding arterial circulation, they are distributed to the smaller centers, and there retailed out to individual purchasers. The wealth of the world thus seems to flow in a system which is provided with appropriate organs, each of which performs its independent function.

Exchange is a mode of acquisition, a means of gain. The value, or rather the price, of a commodity is increased every time it is exchanged. This may be effected in several ways. The most natural and simple method is by constituting the exchanger the mere agent of the producer and remunerating him for his services. The amount paid the agent is then added to the price of the merchandise. The next most simple method is to compensate the agent by a commission computed upon the value of the goods, which is by him added to it when sold. But the most common way consists in the absolute sale of the product by the producer to the merchant, who adds to it as much as the circumstances of competition, etc., will admit of, and transfers it again absolutely to the second purchaser, and so on, till it reaches the party who is to derive direct benefit from it. The convenience of this method, as well as its disadvantages, are apparent. The producer is relieved from all the responsibility of seeing his productions disposed of, and this is a decided advantage; but the vender is thus frequently enabled to add a much greater increment to their price than is sufficient justly to compensate him for his labor. True, he is held in check by competition, and by fear lest it may perish on his hands, but, by co-operating with others situated similarly with himself, a concerted plan is easily arranged, by which all are enabled to demand more than a commodity is worth. This concert of action is called monopoly, or at least it is of the nature of monopoly, in which all thus leagued together constitute a sort of corporation. Now, the mere transfer of products is a very low order of labor. The mental qualities required to perform it are of the most ordinary and inferior kind. A certain degree of skill may be acquired in this as in all other things, and more in the sale and exchange of some articles than of others, yet there is in mercantile business no such merit, no such useful quality, required as in the production of the objects sold. In a perfect social state, therefore, the lowest compensation would be allowed for this species of labor. On the contrary, we frequently find this labor more highly rewarded than any of the most thoroughly trained mechanical professions. It is the mercantile class which most rapidly absorbs wealth, and which usually produces the men of princely fortunes. It is a rare occurrence for the most thoroughly skilled artisan to amass a large competency by the diligent prosecution of his trade, but it is a common thing to see mere dealers in the products of such skill become millionaires by reason of large profits secured by shrewd management.

Again, there is no doubt that the machinery of exchange has become, in all advanced civilizations, far too complicated, and is absorbing and diverting from productive industry much too large a proportion of the population. Productive industry alone can maintain the life of society. All other industries are taxes upon this to the precise extent to which they draw off from the numbers engaged in it. They are, therefore, in the abstract, evils, and should only be tolerated as far as they are absolutely necessary to secure the full enjoyment of the objects of production. Exchange is not only secondary and subordinate to production, it is a mere incident to the separate local condition of consumers. And the same is true of commerce and finance. But I am now considering exchange in its legitimate bearings only, and shall presently treat of all forms of distribution, more especially in their illegitimate consequences as modes of acquisition. The necessity of a system of exchange is obvious, and, even if it were confined within its legitimate limits, it would constitute a great industry, and occupy a large part of the human race.

Little can be said of the indirect moral advantages which grow out of this industry. Its influence upon character is rather softening than dignifying. It stimulates no romance or adventure, leads to no discoveries, arouses no great passion but that of avarice. Still, the ambition to succeed in business, so strong in the mercantile world, is a healthy one, and is sufficient to sustain thousands of active lives.

Finance.—We pass now for a moment to what we may call the financial industry. The necessity for a medium of exchange and the genesis of finance have already been touched upon in the present chapter. The success, however, of the financial industry depended wholly upon its being a means of acquisition. Before it could be made available as a social economic institution, it must be placed upon a footing which should be profitable to those engaged in it. This was the first condition of its existence. The mere manufacture of this medium, the mining of metals, the stamping of coins, the manufacture of paper, and the printing of paper currency—all these, as the creation of useful commodities, belong to production, and those engaged in them to the productive classes. To this, of course, is incident the natural profit which accrues to productive labor. But, aside from this, it was necessary that a profit attach to the mere manipulation, so to speak, of the medium of exchange. The adoption of such a medium implies a demand for it sufficient wholly to withdraw the labor of some from the other industries. The increased recognition of the advantages of this institution, and the multiplied complications growing out of its general introduction, still further enlarged the scope of the financial industry, until it at length reached the enormous magnitude and importance with which modern society has endowed it. And, although, as we shall presently see, this importance is greater than it deserves to be, nevertheless it can not be denied that the legitimate functions of finance, as a convenient device for facilitating exchange and distribution, are very essential; and the number of individuals really required to give it its maximum efficiency, as a servant of man, must be large and respectable. For, besides those actually employed in handling money, there is the long train of consequential agents required to perform the incidental but more laborious duties.

The term "money" possesses a very extensive application, and may be used to designate not only the original medium, possessing as it must an intrinsic value equal to that which it is employed to represent, but every kind of current or negotiable paper, stock, security, or collateral, which is the representative of value, and convertible into specie or merchandise. Any obligation to transfer to another a specified amount of value, whether it be in the form of a current bank-note or merely a registered account, belongs essentially to the financial department of human industry; and hence there should be accredited to that department all those engaged in the exchange, circulation, negotiation, and registration of such obligations.

Beyond its direct advantages, still less can be claimed for the financial than for the mercantile industry. Its perpetual tendency is to magnify the importance of that which adds nothing to the general wealth, and to stimulate a hope and an effort to secure value without producing it. At the same time, it is as barren of inspiring and ennobling elements as it is possible for an industry to be.

DISTRIBUTION AS A MODE OF ACQUISITION.

It remains to take a summary view of the three distributive industries as modes of acquisition, with special reference to their general influence upon society. When it is said that they are necessities to the development and even to the maintenance of the race, that they were the spontaneous outgrowths of social conditions demanding them, and that they have well and thoroughly performed their respective functions, none too high a eulogium has been pronounced upon their direct and legitimate influence on civilization. But I have gone further, and pointed out the indirect influences, both good and bad, which are to be justly ascribed to these extensive and important industries. The meagerness with which, in so summary a treatise, I was compelled to perform this latter task, seems to require, as a supplementary consideration, that a few words be devoted to a somewhat more minute examination of the most important of these indirect consequences, and particularly such as have grown up in virtue of the character which these industries assumed as modes of acquisition.

I have heretofore dwelt especially upon the important principle that the preservative forces impel men only toward the single end of securing the objects of desire, that they possess no moral or rational quality, never inquiring into the justice but only into the feasibility of a scheme. The result of this is the perpetual clash of interests, and the certain triumph of the stronger. It is the operation of this principle which has produced such important consequences in the history of distribution. We have already seen that every opportunity of securing these objects has been seized upon, and every available means to this end employed. The forcible wresting of the desired objects by the physically stronger from the weaker met with a check at the hands of government, which was instituted for the purpose, and the physical force impelling to these acts was commuted into a more and more modified form of intellectual force. Cunning took the place of muscle, and exhausted every means of obtaining all forms of wealth. All embarked in the same enterprise of getting, but in different ways. Those who chose the modest part of producing wealth were placed under comparatively little temptation to grasp more than the true value of their labor; while those who assigned themselves to the non-producing division of society soon found themselves in the enjoyment of greater or less facilities for inequitably augmenting their gains. That such was the case was the fault neither of the individuals nor of society. It was simply due to the state of things in an unconscious universe (vol. ii, p. 5), which must necessarily be attended with pain and inconvenience to those who chance to exist under unfavorable conditions. More philosophically considered, it constitutes one of the inadaptations of things to circumstances, one of the imperfections of the social system, one of the discords between force and feeling—a certain increase of which would render social progress and human existence impossible, and enough of which would annihilate all life, as it once prevented its evolution.

The key to the difficulty lies in the circumstance that those engaged in the distribution of wealth come in contact with such large amounts that they can not resist the inclination to absorb into their own possession a proportion greater than is sufficient to constitute a just compensation for their labor. Neither have the means been yet devised to prevent this. To do so is the problem of social economy. The combinations, co-operations, and monopolies already established by shrewd distributors of wealth have become so extensive and complicated that it may require a general social revolution to overthrow them. These industries have absorbed the most acute minds of the world, because they were the levers of power which intellectual force could lay hold of. They have maintained their grasp by dint of every available form of deception, misrepresentation, and strategy, which is all within the legitimate sphere of natural law. The most potent of all the influences wielded by them is that of securing the acquiescence of the victims—for it is a thankless task to labor for the emancipation of a willing slave. This object the distributors of wealth have accomplished by the manufacture of a public sentiment favorable to their interests. This has been done so successfully that, in this age of pretended practical life, any remark bearing upon the greatest economic problem of society—viz., the equitable remuneration of labor and distribution of wealth—is at once branded as "socialistic" and "visionary," as well by those who suffer as by those who profit by this state of things (vol. ii, p. 602).

This exercise of power by the cunning and rich has begotten a hierarchy as marked as the exercise of political or ecclesiastical power ever occasions. It has actually resulted in endowing the non-productive industries, which are really nothing more than the mere incidents of production, with a far higher social rank and respectability than the productive industries by which all wealth is created. Not only does greater gain come into the possession of those whose duties require no skill, no apprenticeship, and only a very low order of intellect, but these occupy a higher social sphere, and both demand and secure the esteem of all classes as superior to those who, by acquired skill, create the wealth of the world. The poor mechanic is taught to look up, as to superior beings, to the wealthy merchant and banker, who have grown rich by the mere handling of the objects which he has produced.

And yet even these are not the worst consequences of this law. Its tendency is to depreciate production itself. It draws away the best minds from productive labor, and induces them to waste their time in speculations—fruitless except for their own temporary gain—with the wealth already created. It prevents the intellectual and moral elevation of producers, thus directly deteriorating the quality and diminishing the quantity of the wealth produced. It has thus worked a complete reversal of the proper order of things, honoring and rewarding the least worthy, and degrading and deteriorating the truly meritorious.

As these facts are the natural result of the operation of the social forces, it is evident that they can be remedied in no other way than by the counteracting influence of other opposing forces. The possibility of these evils which has been ascribed to the mental force can be precluded by a counter mental force. It is not only because some men are wise that they are able to accumulate wealth without earning it; it is equally because others are unwise. In a word, the entire anomaly—the evil itself—is due to the inequality which exists in this power of acquisition, in this cunning, or shrewdness—this mental force. To prevent it, the producer must be armed as well as his enemy. Provided with the requisite knowledge, he will not be deceived (vol. ii, p. 537). As in politics, the victims of power are so because they are ignorant of their own interests, since the ultimate power lies with the people, so in the rule of wealth it is the ignorance of the victims which renders it possible to keep them so. Co-operation is as easy for the producers as for the non-producers, but they do not understand it as well; and, if they understood it, they would lack the intelligence to carry it into practical effect. They are, as a whole, it must be confessed, a less intelligent class. They receive less education in youth and none at all afterward. Their apprenticeship is taken from their school-days, and when active life is begun it requires so many hours of labor per day to earn a livelihood that no time or energy is left for intellectual improvement. The life of the skilled artisan is one of unremitting toil. It is quite otherwise with those who live on the productions of others. Their incomes are so much larger that they can afford their children a liberal education, and find much leisure for general mental cultivation and current information in connection with their business. This is the secret of their success in maintaining their hold upon the wealth of the people. What could be more monstrous to the mind of one wholly unacquainted with the inequalities of society, and unaccustomed to hear of the natural superiorities of certain classes of people over others resembling them in all apparent respects, than to be informed that the venders of goods were able to earn twice as much in half the time as their producers; that by means of co-operation and monopoly those who merely carry merchandise from one place to another are able to make immense fortunes in a few years at the expense of those who consume it! Such a person as we have supposed would first ask why such a state of things was tolerated, but upon a thorough examination would find that it was not only tolerated but acquiesced in without a suspicion on the part of those who suffer most that any thing was wrong. We thus have, in the history of the three great non-productive industries just considered, another illustration of the general truth that out of every useful and necessary institution there will sooner or later grow indirect consequences of a disadvantageous character which go far to neutralize the benefits secured. And so long as society is imperfect (and it never can be perfect), this must continue to be the case to a degree proportionate to that imperfection. The great social forces will go blindly on, regardless of the unpleasant feelings which their action produces, and can only be held in check by opposing forces. These opposing forces can only be of three kinds: 1, the same force exerted by other individuals in a counter-direction; 2, rational forces; and, 3, sympathetic (altruistic) forces. The first of these is best secured by what are called *attractive measures* (*supra*, p. 39 *et seq.*), whereby every encroachment upon the rights of another is followed by certain consequences which can be foreseen, and which are sufficient to counteract it in advance; and by *equalizing measures*, which give each the power to erect positive barriers to such encroachments. The second comes through *education*, which, by equalizing the intelligence of all, renders impossible those infringements of rights which obtain their license through superior cunning and intelligence. The third is the result of high mental and moral cultivation, quickening the sensibilities to a degree which renders the pain experienced in observing the sufferings of others greater than that of foregoing the pleasure afforded by depriving another of a right. Such a force is not a myth, neither is it the common condition of all enlightened men.

I have now passed in review all the forms of industry which are directed toward the acquisition of the objects of human desire, and considered at some length the two great classes of society, producers and accessories to production. It is by the labor of these classes that man has been enabled to acquire a firm footing upon the globe, and by it that all the great results of civilization have been accomplished. Guided by intellect and propelled by want, the human species has built up this great economic system, and worked out its complicated details.

Parasites.

It might be supposed that the analysis above made of the various classes of society, with reference to the modes of acquisition adopted by mankind, would exhaust the subject and embrace them all. But, unfortunately, this is not the case, and we find ourselves compelled to speak of a class which is not only non-producing but non-industrial. To connect the two terms, and speak of a non-industrial mode of acquisition, may sound paradoxical if not paralogical. But the plain fact is, that there are many ways of acquiring wealth without industry. It does not follow that these non-industrial gainers of wealth are all indolent, inert, and inactive. But all activity is not industry. The entire compass of that term has been embraced when we name the producers and those accessory to production. Mere activity, however great and however successful, in amassing wealth, is unworthy of the name of industry, unless, in some way, either directly or indirectly, it contributes to the increase of wealth, *i. e.*, to the increase of the enjoyment of the objects of production upon the whole. Energy, however great, expended in securing the transfer of wealth from one consumer to another, whereby the sum of enjoyment is left the same as before, and only diminished in the one to be increased in the other, is no industry. The distinction should be carefully made between this class of cases and that in which the transfer is from those who can not enjoy it to those who can. This latter case is but the general one of transportation from the producer, who can not consume all he produces, to the consumers at large who can. Activity exerted in this direction is accessory to production, since value must ultimately be measured by enjoyment, and material objects must be present to be enjoyed. The non-industrial or parasitic classes are often the most active and energetic. They are usually the best-informed classes of society, and are wonderfully successful in creating the belief that they are the most important of all the social elements.

As soon as the amount produced began at all to exceed the immediate requirements of life, a struggle commenced for the possession of the surplus. The methods employed were as varied as the human brain was fertile. In the rudest form they consisted in forcible seizure, variously practiced, and gradually softened down into milder and milder methods, till they finally assumed the form presented to-day, whereby thousands of people live in luxury and amass vast wealth without adding any thing to the wealth of the world or to human enjoyment.

CLASSIFICATION OF THE NON-INDUSTRIAL MODES OF ACQUISITION.

In attempting a classification of the non-industrial modes of acquisition, I find many practical difficulties in the way, and do not hope as much to render it exhaustive as to give it a tangible shape for more special consideration. With this object in view, I propose to offer a few suggestions upon each of the following six modes of acquisition, relying, for any degree of completeness which I may attain, upon a certain license to expand or modify the scope of the terms employed.

1. Robbery. 2. Theft. 3. War. 4. Government, or Statecraft. 5. Hierarchy, or Priestcraft. 6. Monopoly.

However well these divisions may represent the chronological order and history of non-industrial acquisition, they may be all found in full operation in the most enlightened nations of the earth. With regard to the moral quality attaching to them, there is far less distinction than the age is pleased to make. Between robbery and monopoly the difference appears very great, but it consists in two things, both of which are quantitative only. These are the rudeness and the illegality of the former as contrasted with the civility and the legality of the latter.

The principle of a procedure is not changed by mollifying the method. The motive is the same. This motive is in all cases the desire to possess, irrespective of the effect produced, and every individual is perpetually striving with all the powers he can wield, and all the forms of power, to appropriate the objects of desire. When the coarser forms of power are cut off, he resorts to more and more refined forms. Robbery is the coarsest and rudest manner in which force can be exercised. It consists in the spoliation of one by another, by virtue of superior physical strength, or by intimidation and threats of personal violence. Theft is a resort to the lowest order of cunning, and takes advantage of the absence, ignorance, or unconsciousness of him from whom property is taken. War, when waged for conquest, is simply robbery on so large a scale that in the crude conceptions of men it arouses the sentiment of honor. The progress which has taken place in the modes of warfare is analogous to that in all other modes of acquisition. The direct animal methods first gave way to deception in the form of mere *cunning*, but these became condemned as *treachery*, and have in turn given way to an elaborate code which admits of modified forms of this deception known as *strategy*, but which is even more effective than the cruder forms. Between robbery and war lies brigandage, which is regarded as more or less honorable, according to the degree of moral development of the party contemplating it. Once generally sanctioned, it is now generally rebuked, and war is passing through the same phases.

War.—Passing over robbery and theft, which, though prevalent enough every-where, are not recognized by society, let us consider war, for a moment, as a non-industrial mode of acquisition. In modern times, most wars have some pretext besides that of aggrandizing the victorious party engaged in them, although, in nearly all cases, this latter is the real *casus belli.* This shows that the world is so far advanced as to be ashamed of the motives for its conduct, but not enough so to affect that conduct materially. In olden times no secret was made of the fact that the object of military expeditions was the acquisition of the wealth of the conquered people. Such was the nature of Alexander's conquests, of Cæsar's wars, and even of Napoleon's campaigns. Indeed, not a war can be mentioned, from the invasion of the Israelites, and their brutal and atrocious conquest of the industrial inhabitants of Palestine, to the achievements of Charles XII of Sweden, which did not have for its avowed object the appropriation of the possessions of those against whom it was waged. The valuable object which it is sought to secure by war is usually territory, and such wars are termed wars of conquest. But land is as much property as other things, and often becomes the subject of other non-industrial modes of acquisition. And with territory, such as is always the subject of conquest, there always come many other valuable things—not only the power over people and the title of sovereignty, but the revenues of tribute and taxation, all of which go to enrich the ruling classes, who are the conquerors themselves. Until recently, it was customary for the conquerors to parcel out the best lands among the most valiant of the military chieftains, and in all but the most enlightened nations this custom probably still survives. All Europe, not excepting the British Isles, has been so parceled out, and much of it more than once. Careful study of the agrarian history of India reveals the same fact there, and it seems to have been general throughout Eastern and Central Asia. The well-known subdivision of Alexander's Asiatic, European, and African conquests constitutes a modified illustration of the general principle here referred to.

We may regard war, then, strictly considered, as a mode of acquisition, and as such it has played a most important *rôle* in human history.

Government, or Statecraft.—It may sound strange to class government among the modes of acquisition. But, as will be shown in another part of this work (vol. ii, p. 223), government, like most other human institutions, has been the product of egoistic attempts on the part of *crafty* individuals to meet and supply a popular demand. It has not, except in this sense, been the product of a popular attempt to avert a prevalent evil. It is not the victimized many who rise *en masse* and organize for their own protection. It is the keen-sighted few who perceive the wants of the many, devise means to supply them, and anticipate rich rewards from the befriended and grateful community. This reward is proportioned to the success of the scheme, and hence the adaptation of government to public need.

This is the essential quality and necessary genesis of government, which, like all other human institutions, has to be moved by the great natural social forces. It has required that it be made a means of subsistence—a profitable business—for those engaged in it. And, independently of any benefits secured by it, it must be regarded as one of the activities of human life, having for its object the aggrandizement of self. In so far as it is a necessity, in so far as the ruling classes can be regarded as the business agents of the people, government may be considered an industry. As such, these agents may be referred to one or another of the classes of accessories to production above described, or possibly, in a very few cases, to the producing class itself. To this extent government is no more than an extensive popular industrial establishment (vol. ii, p. 245). But this scarcely at all applies to the so-called governing classes. It applies, to a greater or less extent, to the large number of inferior officers of government upon whom the labor of this establishment falls. And, in so far as this labor is really accessory to the production of a country, these should be assigned to the industrial classes. A great part of this labor, however, is done for the simple gratification of the caprice of superior officers and for their personal emolument, and such services, though not the fault of those who perform it, are outside of our technical definition of industry. The higher officers of government are usually more or less purely parasitic. Their labors, where they labor at all, add nothing either directly or indirectly to the wealth of the country or of the world. The only effect exerted by their activities upon wealth is to cause it to flow from various sources toward themselves. In countries not republican in form there is often no claim made by the greater part of the ruling classes to services rendered the commonwealth. They receive appropriate titles, which are accompanied with large revenues from the public treasury, and upon these they live in ease, elegance, and luxury, without pretending to any kind of reciprocal service.* Others—as, for example, the Lords of the British realm—have, by

* See the "parable" of St. Simon in Blanqui's "History of Political Economy," p. 497.

virtue of their titles, the right to sit in the Upper House and assist in legislation. But, as they are responsible to no one, they often make this their opportunity better to carry out the law of self-protection, and antagonize, in their own interests, the interests of the people.

Only a small part of the duties of the ruling classes, where any duties are performed at all, can be called other than egoistic activities. The fact is patent, and the reason is plain. The revenues of a country are a tempting bait to designing men, and these are perpetually striving to get possession of a portion of them. By succeeding in installing themselves in positions of power, they are en bled to operate in two directions: first, in that of increasing these revenues; and, secondly, in that of obtaining a larger share of them for themselves. Governmental positions, thus extending the promise of large remunerations, and of power to increase them, become great *desiderata*. The government soon finds itself overrun with officials, and besieged by influential men to make room for more. And, as all that is required to accomplish any object is the requisite power, these succeed in forcibly enlarging the circle of governmental capacity and establishing themselves within it. All the attractions are in that direction, and especially the pecuniary attraction. Unlike the ordinary fields of industry, which must obey the laws of competition, supply and demand, government possesses almost inexhaustible resources, only limited by the production of the whole country and the patience of a credulous people in bearing with taxation, while its real or nominal functions may be indefinitely multiplied and enlarged. And thus it is that every government is always drugged with sinecures and every industry burdened with unnecessary taxation.

Hierarchy, or Priestcraft.—We are next to consider *hierarchy* * as a parasitic mode of acquisition. To prove it para-

* The term *hierarchy* is here used in its primary and most legitimate sense of *sacerdotal government*, or, as defined "dominion or authority in sacred

sitic, it needs only to be shown that it adds nothing, and aids in adding nothing, to the production of the objects of desire. But this would be a wholly superfluous declaration. The benefits which it is believed that the priesthood confer are not to be enjoyed in this life, and therefore can not, by any process, be connected with human economy. If it be said that in a certain sense the clergy are teachers of the people, and should be classed with those who make this their profession, and from whom it is acknowledged there rise the greatest of indirect benefits to material prosperity, the answer is that in so far as they are diffusers of knowledge they are not priests. It is quite possible to combine several classes in one and the same person; and, when we class all the priesthood as parasitic on productive industry, we are regarding each in that capacity alone. If any one be both priest and teacher, or both priest and mechanic, it is as priest that we place him in the parasitic, and as producer that we place him in the industrial, class. But, if it is claimed that doctrinal teaching, which alone characterizes the sacerdotal state, adds any thing to human knowledge, the position must be rejected as one wholly false and untenable, and for the simple reason that by no possibility can such teaching lead to better methods of obtaining or creating the objects of desire.

If all the religious training the world has ever received should be concentrated upon one community and thoroughly indoctrinated into the mind of every member of it, it would be utterly useless as a means of carrying it through an ordeal which threatened it with famine or destruction from climatic influences. Equally futile would be the prayers of all the devout of the world in such an emergency. Not one of all the wonderful contrivances invented by man for extorting subsistence from nature, for destroying the enemies to man's triumphant progress, for multiplying the objects of desire

things." The word *priestcraft*, ignoring a certain popular stigma which it has acquired, more nicely conveys, through its second component, the special notion involved.

or for neutralizing the physical forces operating adversely to human life, has ever been attributable to the labors of the priesthood as such, and none of these blessings can ever come, either directly or indirectly, from that source. Yet, from the infancy of the race, this class of persons has enjoyed a far greater share of the fruits of industry than the producers of wealth themselves. Sacerdotal duties are, and always have been, a special and exceedingly lucrative means of obtaining a livelihood.* They constitute a well-marked and extensive mode of acquisition. It required only a little more than ordinary sagacity to perceive that appeals to the sentiment of fear respecting the unknown, in a state of society where so little was known, would exert a powerful influence, and a little calculation was sufficient to determine the best means of making this influence operate in the direction of conveying pecuniary value into the possession of any one who should successfully devise such a scheme. The result has been that long before history began the earth was decked with costly temples, and within them a well-fed and comfortably clothed priesthood sat enjoying, all unearned, the luxuries vouchsafed by toil and credulity. The reign of this parasitic hierarchy still continues all over the world; and still, to-day, the hard labor of the masses, just saving a subsistence, is paying its tithes to the support of this great non-industrial class, and for the erection of costly edifices which the state exempts from taxation, and which serve no other purpose than to be opened once in each week that honors may be paid and anthems sung to imaginary deities. When we consider the universality of this hierarchic system, it presents one of the most extensive drains which are made upon the productive industry of the world.

* The clergy of certain modern Protestant sects, as the Methodists, for example, form an exception to this remark, except in the case of the higher church dignitaries; a fact which some regard as marking the decline of the religion, and pointing to its fall when it shall have ceased to furnish material support to its priesthood.

There is no more successful mode of acquisition than the ecclesiastical. The priests of Brahma, of Buddha, of Osiris, of Ormuzd, of Jehovah, of Jupiter, of Jesus, and of Mahomet, have all, in their respective lands and ages, been the recipients of the richest material bounties which earth and human toil could bestow, often attaining to supreme political control. The uncivilized world is still the more or less absolute victim of this costly superstition, while in the most enlightened nations of Europe the "First Estate" is receiving and enjoying, without labor, the wealth created by the productive industry of the Third. The enormous salaries received by the clergy in all countries having an established church is enough of itself to substantiate this view.

Monopoly.—Under the head of *monopoly* as a mode of acquisition may be classed all those schemes by which, through the co-operation of those engaged in the distribution of products, whether in their transportation or exchange, or in the financial operations arising out of these industries, the prices of commodities to the consumers are increased out of proportion to the labor expended upon them, or the medium of exchange is made to fluctuate in value so as to affect its purchasing power, in order that the monopolists may make large gains based upon such fluctuations.

The great preservative force manifests itself in a universal effort to acquire wealth. So long as the motive is a scarcity of the means of subsistence, it is directed wholly to their production. The physical faculties are first exhausted, to find all that Nature herself yields; then the lower mental powers are brought into play to secure that which was before out of reach; after this, higher orders of thought become necessary to devise means of inducing Nature to yield more than her spontaneous supply. Art and science are thus ultimately brought to the task of supporting human life. All the great necessary industries, by which alone the fruits of labor can be universally enjoyed, follow in due course. Transportation, exchange, finance, spring into being. Plenty follows thrift, and the earth teems with abundance. But avarice survives, and the love of accumulation, once and still so essential to the preservation and advancement of the race, now revels in the created wealth amassed. The same powerful faculties, arts, and devices are now employed to attract this created value as were employed to create it. Production requires physical exertion, protracted labor. It becomes irksome, repugnant. The more sagacious shirk it, throwing it upon the more simple, and spend their time in devising means of reaping its benefits. That which is disliked loses its respectability. The humble artisan and peasant come to be looked down upon as inferior to the proud designer, and the most unworthy of the race are taught to believe themselves "better" than the most worthy.

Of all the methods employed to attract created wealth, that of organized co-operation has proved most successful. There is not a department of industry which has not been made a prey to this powerful influence. The only one which has enjoyed a partial immunity is that of production itself. The number of producers is so great, and their special duties so varied and dissimilar, that co-operative production could only exist in a state of liberal and advanced intelligence. This they have not enjoyed, for reasons already set forth. The non-producers have therefore had full possession of the field.

These latter classes have carried on their operations along four different lines, in which the forces of aggrandizement have been represented by four corresponding great powers. These powers are: the military power, the political power, the sacerdotal power, and the speculative power. The first three of these have already been brought under consideration, and the fourth therefore only remains. Just as men have banded together into an army for the conquest and plunder of all from whom value could be taken, just as they have plotted to govern the people that they might share the revenues, just as they have co-operated in forming an ecclesiastical oligarchy to obtain offerings from the credulous masses through awe-inspiring teachings, so also have they controlled the distributive industries by watching the movement of the products of labor through these channels, and have been able to organize and control that movement in their own interests.

Monopoly of Transportation.—The monopoly of transportation, though late in its complete development, has become an enormous drain upon the production of the world, placing vastly exaggerated shares of the objects transported, or of the value they represent, into the hands of the transporting companies. The absolute necessity of transportation to the distribution of products, and especially the great cost of the means of transportation, have rendered this an easy branch of industry to monopolize. Since the introduction of railroads, where these are built and controlled by private corporations, the temptations to, and practice of, monopoly have become so great that many seem to have forgotten that this evil can exist anywhere else, and we find one class of monopolists, the monopolists of exchange, organizing against this class, the monopolists of transportation, as the only monopolists.

Monopoly of Exchange.—The monopoly of exchange is of remote origin, and is the most extensive of all monopolies. The system adopted by producers of transferring absolute possession of their products to those who are to dispose of them enables the latter to make an almost unlimited profit, provided a sufficiently extensive co-operation can be effected. Happily the mercantile industry is so large that there must always be a limit to this co-operation, and, therefore, no ruinous lengths can ever be run, yet it is usually possible to reserve a much greater share than is sufficient justly to recompense the labor expended in exchange.

Monopoly of Finance.—Not less formidable is the financial monopoly. A certain substance made into a certain form and bearing a certain stamp is made the representative of its own intrinsic value, in any form whatever. The existence of this circulating medium gives rise to special enterprises for the exchange of this only. As wealth increases more rapidly than money, and the exchange of products becomes too great to be carried on with the amount of the circulating medium, resort is had to paper money, in the nature of obligations to pay in the recognized medium. These obligations, in the course of time and the demands and vicissitudes of trade, assume a thousand forms, and become loaded with infinite complexities, giving extent and importance to financial enterprise.

It would be marvelous if those who become initiated into all the mysteries of financial manipulation did not learn with the rest how to absorb a large amount of these various representatives of value. No field of speculation offers such temptations, and, while a lack of tact and cunning is sure to be attended with ruin, the successful are loaded with wealth. Such a field is never without its organized monopolists, who do nothing but watch their chances to sweep down upon the fruits of human toil and with a stroke of the pen brush into their money-drawers the patient labor of years. Though a somewhat hazardous one, speculation in paper obligations is an extensive business, a successful mode of acquisition, and a dangerous monopoly.

Monopoly of Labor—Slavery.—It will be seen that the chief forms of monopoly are immediately connected with those industries which are only accessory to production. This is natural, since it is so much easier to attract created than uncreated wealth. When we deal with production we are dealing with labor, and monopoly of labor requires a control and management of the person of the laborer. This is more difficult than the control of inanimate merchandise. Nevertheless, it has been extensively done. For what is human slavery but a monopoly of labor, a non-industrial mode of acquisition, a parasitic way of gaining a subsistence? And slavery is one of the great human institutions which have existed from the earliest historic times, an institution which is only now disappearing from the most advanced nations.

Monopoly of Manufacture.—Besides that personal form of monopolizing labor which is called slavery, there exists in all great manufacturing industries a large amount of monopoly of a somewhat different kind. It is the monopoly of capital, which denies to the true producer the product of his labor, pays him meager wages, and derives large profits from the manufacture. But this is the least objectionable form of monopoly, since, thus far at least, co-operative labor has failed to establish those extensive manufactories which capital creates, and which are so necessary to the material advancement of the world. And yet it is through the organization and co-operation of labor that all monopoly is to be prevented.

Remedies for Monopoly.—The *natural* antidotes to monopoly (*i. e.*, where no attempt is made at social regulation) are counter-monopoly and competition. But these two are essentially the same, counter-monopoly being only competition of monopolies.

There is a constant antithesis between competition and co-operation which applies as well to the non-producer as to the producer. Co-operation always tends to reduce competition, and competition denotes want of co-operation. Whether competition can be trusted to prevent monopoly depends upon the degree of co-operation, and no equitable adjustment of the various relations of industry can be made so long as different industries manifest different powers of co-operation. As society is now constituted, it is the non-producing classes who co-operate most and compete least, while the producing classes co-operate very little and compete strongly. Co-operation is an artificial principle, the result of superior intelligence. Competition is a natural law, and involves no thought. Hence those who co-operate thrive at the expense of those who compete. Production, therefore, at whose expense all or nearly all this monopoly is carried on, must, if it would hope to escape it, organize and co-operate for its own protection. It has, in the end, the power to control all other interests, since it is the source of all about which there can be any interest. Capital is transient. It can not continue to multiply itself after the source of its supplies has been cut off. Labor must retain possession of its products, and only transfer them to the consumer, making the processes of distribution wholly dependent upon and subservient to those of production. But this can only come of greatly increased general intelligence, particularly on the part of the producers themselves, and for a long time to come we may expect that the whole train of monopolies will go on as they have gone on from time immemorial.

GENERAL OBSERVATIONS ON THE PARASITIC CLASSES.

This brief sketch of the parasitic classes of human society, though manifestly imperfect, is sufficient to show that the acquisition of property and money can be and is conducted in many ways which add nothing to the wealth or material progress of the world, and contribute nothing to the supply of the natural and necessary wastes of existence. It suffices to show that a very large part of the human race is thus wholly parasitic, and that another part is partially so. And all the while that these are securing the transfer of value unchanged to their own possession, they are consuming the objects of production, and charging the productive industries with all the labor and loss which their activities occasion.

The existence of purely parasitic classes in society must be contemplated as a cosmical fact. Thus viewed, it will not only be better understood, but need be no longer deplored. It affords a striking proof of the essential homogeneity of the process of cosmic aggregation throughout all departments of phenomena. We saw, when dealing with organic evolution (*supra*, p. 350), that, from the point of view of biological economics, protists and plants are the producers, while animals are parasites. Yet the latter assuredly represent a higher stage of development. They are a true *aristocracy* in the organic world, and illustrate the methods by which nature accomplishes the successive steps in evolution. Not otherwise must we contemplate the phenomena of social parasitism. It can not be denied that this class, measured by nature's criterion—its fitness to survive—occupies a higher social rank than that of the producing class. We contemplate the animal world as an end in and for itself, and, as such, we say that it represents a grade of progress above the plant. Relieved from the necessity of manufacturing the organic materials of which it is composed, it can devote its energies to higher operations, including those which have no other object than to secure the individual's well-being and enjoyment. And thus we may equally regard the parasitic class of society as an end to itself. Relieved from the drudgery of production and distribution, this class devotes its energies to the attainment of the maximum personal well-being or happiness. As this is the ultimate end of sentient life (vol. ii, p. 111), it is of course a legitimate form of activity, being the same end at which the producer is also aiming.

But, true as all this is, the unphilosophical need to be cautioned against giving it too comprehensive an application. Applied science is essentially humanitarian; applied sociology must be especially so. While fully recognizing all such facts and homologies as those just pointed out, the sociologist must also teach that, just as each member of society legitimately seeks his individual welfare, so society as a whole must seek its collective welfare, and that it is the duty of society, in its collective capacity, so to regulate the phenomena of the social aggregate as to prevent, as far as possible, the advancement of a small class at the expense of a large one. Here especially must the error be avoided of imagining that what we find in nature must therefore be the best. Nature is no more anthropocentric in the higher than in the lower fields of phenomena (vol. i, p. 71; vol. ii, p. 50).

I have now completed the outline, which I had proposed to myself, of the operations of the preservative forces of society. I have shown how man in his perpetual pursuit of subsistence has organized and carried forward a grand economic system, and how all this imposing material civilization which we see around us is but the magazine which he has built and the stores which he has placed in it in order to escape the pains of hunger and cold. And, while it must be admitted that a vast deal of this goes to the gratification of higher and more refined desires than those of eating and of being comfortable, still, these higher pleasures are all subservient in an indirect way to the same ultimate end, the preservation and security of vital existence. Any thing which can be shown to have any, even the least, influence in placing human life upon a surer footing, is a proper element of preservation (*supra*, p. 563). Many things commonly regarded as luxuries come under this head. Facilities for intellectual culture are the indirect means of securing the most certain guarantees of perpetuity. Even the softer arts often exert an influence ultimately beneficial for this purpose. As a general principle, it may be assumed that whatever tends to refine, elevate, or perfect the race, diminishes the chances of its ever suffering extinction. The multiplicity of faculties and susceptibilities is what measures the degrees of perfection, and this multiplies proportionally the adaptations to circumstances; and, as we have seen, it is this adaptation to circumstances which alone determines what species shall survive, and insures their persistence.

II. The Reproductive Forces.

Having considered the Preservative Forces as the first and greatest of all the motives to human action, I now proceed to the investigation of the other great co-ordinate moving power—the Reproductive Forces. The special office of the former is to prevent the destruction of the race by preserving its physical vitality; the special office of the latter is to prevent its extinction by the reproduction of individuals. The one operates for the *present*, the other for the *future*. The one preserves the *individual*, the other preserves the *species*. It is the function of the first to secure an average normal duration of vital existence; it is the function of the second to evolve from each life the germs of a new generation.

The biological importance of these two processes being equal, no comparison can be instituted. Both being absolutely essential to the continued existence of the race, we must confine all comparison to the secondary effects which each has produced upon society, and which constitute the sociological elements. Here, however, we are afforded an ample field. The two classes of influences which are exerted by the two forces are very unlike, and constitute them wholly distinct, though equally important and interesting, departments of sociological study. It may be remarked generally that the results attending the operations of the Preservative Forces are, from the point of view of social progress, greater, more obvious, more varied, and more comprehensive than those attending the operations of the Reproductive Forces. The former underlie all the great industrial, economic, and acquisitional movements of society. It is to them that must be attributed all the progressive institutions, all the wealth, all the invention, all the civilization of the world. The latter, on the other hand, while they call forth the most intense activities, do not direct them toward the production of wealth or the advancement of thought. Their influence is internal, rather than external, molding rather than creative. The normal effect of the former is to organize human happiness, and carry it up into higher and higher spheres, furnishing new and more complex objects for the gratification of new and more delicate faculties; the normal effect of the latter is to throw over society a softening and refining charm, without which all other forms of enjoyment would be insipid. The one deals with the hard and practical side of life, and its history is characterized by bold and positive inroads upon nature; the other, though not without its asperities, is chiefly characterized by a conservative shyness before innovation and an indifference to progress. The story of the forces of preservation is an epic; that of the forces of perpetuation is a lyric.

Civilization may be said to be the product of three great forces: those of the stomach, those of the loins, and those of the head. The first is the propelling power, the second the refining power, the third the directing power. The first two are positive, aggressive, initiative; the last is merely supervisory.

With regard to the positive social forces, it may be remarked that they are distinguished from the directive force by one essential element, that of invariability. The quantity of intellectual force is contingent and dependent. It is a variable quantity. It has been steadily on the increase for ages, and is supposed to have been in a state of development from the earliest period in the history of man. It is undergoing perpetual change every-where, is subject to circumstances, and may be increased by a thousand conditions, both natural and artificial, the most important of which is education (vol. ii, p. 483). And there is no doubt that it may be and is also subject to diminution. Quite otherwise with the positive social forces. They are permanent. Neither natural nor artificial causes can ever avail to increase or diminish them. No matter against what obstacles they contend, no matter with what success, they are ever active, ever equally intense. If too great obstructions intervene, the only effect is to arrest motion. The forces are unabated. They are true natural forces. Their operation is direct. They tend to produce motion in a right line. Obstacles in their course are only the objects of resistance, tending to bring about equilibrium. When motion ceases, it is because the resistance is equal to the propelling force, the reaction equal to the action. The latter is not diminished. It is uniform wherever life exists, and only ceases when life is extinct.

It is hardly necessary to explain that, by *invariability* and *uniformity*, as the terms are here used, it is not meant to assert that the human appetites are at all times and under all circumstances the same in any given individual. On the contrary, they are capable of being wholly appeased by the possession of the objects desired. But it is the recurrence of these desires, on the withholding of the objects for a definite period, which is so certain. Neither is the intensity of these desires precisely equal in all individuals; still, the average intensity is nearly the same at all times. Nor do I assert that these appetites are not greatly modified and affected by both natural and artificial surroundings. I mean simply that they are incapable of serial differentiation either upward or downward, like the mind-force. Within certain comparatively narrow limits they are fixed, uniform, and universal.

The Physical Aspect.—As an introduction to the consideration of the reproductive forces, I find it absolutely necessary to deal somewhat specially with the physical aspect of the question. Whatever may be the notions prevalent of the relation of the mind to the body, few will insist that there is any great degree of independence between the procreative instinct and the physical organs of procreation. Just as, in the preservative forces, the nature of the desire is physical, and gratification is only obtainable through actual contact with those parts of the nervous system in which the desire is seated, so in the reproductive forces it is only through the appropriate nervous excitation that the systemic equilibrium can be restored and the appetite temporarily appeased.

Before proceeding further with this part of the discussion, deference to established custom constrains me to offer to the reader all the apology in my power for its introduction. He may rest assured that it is not of my own choosing. It simply lies before me, and without it the system would be manifestly incomplete. I am aware that it is customary to hand over such topics to the medical writers, as if there were some necessary connection between them and disease. But this can not be done here, because it is not the pathological state, but the strictly normal operations of the individual units of society, that must be considered. Moreover, the treatise professes to be scientific so far as the infantile state of sociology will permit, and science has never found it possible to defer to the prevalent sentiments of delicacy which are properly recognized in all the departments of literature proper. The biologist is confronted with the fact that it is upon the reproductive system that he must depend for the very foundation of his classification of both animals and plants; and about the first important work that ever appeared on the real science of man, Mr. Darwin's "Descent of Man," is little else than a treatise on the sexual relations of man and of those inferior creatures whose actions throw light upon the problems of anthropology. Yet no one regrets that great work, or deems its celebrated author's mode of treatment in the least improper. All truth is proper and dignified. *Quicquid essentia dignum est, id etiam scientia dignum.**

And now sociology, in passing from the field of mere literary speculation into that of true science, finds it impossible to advance, so long as any great class of facts remains closed to its investigations.

Feeling vs. Function.—The physical organs of reproduction may be considered in a twofold aspect, viz., 1, as the seat of a special class of desires; and, 2, as nature's means of continuing the race; *i. e.*, from the point of view of feeling and from that of function. In this respect they are in close analogy with those of nutrition. These two qualities are in

* Bacon, "Novum Organum," lib. 1, aph. cxx.

both cases distinct and independent. There is even less relation discernible between the sexual desire and the procreative function than between taste and digestion. The mind may frequently dwell upon the latter during the performance of the act, but it rarely dwells upon the former; and, when it does so, it is through the rational faculties and not spontaneously. It is not supposable that animals ever connect either of these acts with their consequences while performing them. To such as reject all teleological explanation of the adaptations in nature, there remains only one other explanation. This consists in the theory that the combinations were originally infinite in variety, and only such succeeded as proved harmonious—a sort of "pre-established harmony" doctrine, with this important qualification, that to every harmony there were myriads of discords, and that while the latter perished immediately the former survived. Even as a theory and a speculation, I claim for the latter of these explanations a decided superiority over the former. It relegates all natural adaptations to causation or necessity, and takes them out of the hands of arbitrary free-will and foreordination on the one hand, and of mere chance, or fatality, on the other. But, whatever may be the true explanation, the fact is obvious that, between the two, to all appearances, generically distinct phenomena—the excitability and the fertility of the reproductive organs—there exists an admirable adaptation, without which the latter function must fail and life immediately cease. One great law permeates the whole sentient world, that before there can be action there must first be desire, that action can only be performed in obedience to desire. And it is wholly immaterial whether there be any rational dependence and visible connection, any known relation between the desire and the action or not, so long as the action is performed and its own peculiar consequences flow from it. In fact, both in nutrition and fecundation the proper functional organs are not the same as those which attract to the performance of the acts necessary for nourishing and fecundating. There are distinct sets of nerves, located in different parts of the body, for the latter functions. The tongue and palate are the chief attractors of nutriment, though quite remote from the seat of the digestive and assimilative processes. And although the stomach itself is a seat of pleasurable excitement, still this grows fainter and fainter in proportion as the real life-preserving benefits of the food take effect. All this has its exact counterpart in fecundation, even to the stimulation of the secretive glands necessary to each of these processes. Viewed from this stand-point, all physical functions are homogeneous.

From the twofold aspect presented by the physical organs of reproduction, there naturally comes a corresponding division of the subject of reproduction into two parts, one of which confines itself to the results which flow from the sexual instinct itself, and the other to those dependent upon the generative function. The first of these classes of effects may be denominated direct or causal, the second indirect or consequential. With regard to the first of these divisions, the analogy holds strictly with the preservative forces. Both are mere desires—physical excitations—propelling individuals to such acts as will best afford the gratification craved. Both deal with voluntary human actions and their consequences upon society, independently of the physical consequences accruing to the individual. But when we come to the second division we find a divergence, which grows out of the radical difference between the natural consequences, or indirect effects, of the two classes of acts. The consequence, or indirect effect, of the nutritive act is to supply the body with the nourishing materials required to sustain life. The consequence, or indirect effect, of the reproductive act is to beget offspring. The two results are wholly unlike. In the first, no radical changes take place in the system. Here the analogy holds good of the male, but not of the female. But beyond this alone it ceases. After having partaken of food, every thing remains as before. No ulterior consequences follow. No new element is introduced into society. Nothing is added to society. But in the case of reproductive acts, besides the immediate change wrought in the female, there is soon added to society a new being, so different from the parents as to require special modifications of the whole social attitude to adapt itself to the new condition.

The existence of children in society is a very important molding fact. Upon it depends the whole system of patriarchal institutions. Out of it has grown that immense social factor, the family, and out of the family have grown gentes, tribes, and nations. From it proceed new desires and new classes of desires, which are attended, like all desires, with their appropriate train of activities. Parental affection, consanguineal predilections, and particularly maternal love, have proved immense social influences, doing much to bring society to its present condition.

The nature of this discussion requires us to confine ourselves to the first of these divisions of the subject, to the train of circumstances which attend and follow the mere desire to perform the reproductive act, wholly independent and neglectful of its indirect or physical consequences.*

The field of investigation is less broad, perhaps, but even more interesting and remunerative, than that just passed over. At the outset we are met by a distinction not before found, growing out of the fact that this desire is of a dual and recip-

* The second branch of this subject is not omitted because its importance is under-estimated, but because it has no direct bearing upon the genesis of society. It would be much easier to treat, because so frequently treated already. In fact, the direct or causal phenomena of reproduction as well as of nutrition have been wholly neglected by all writers on social questions, which is certainly a very remarkable omission. Thus far, I believe, no clear and comprehensive conception of the nature of the social forces has been formulated. I have for years watched with great care the drift of all the thought with which I have been able to acquaint myself, with the special view of observing to what extent this idea was dawning upon the world, and, although I have noted several adumbrations and fleeting glimpses of the truth, nothing like a comprehensive view of its nature and bearings upon society has yet been detected.

rocal nature. The objects of the preservative force are external things. The relation is between man and the outside world; and even among cannibals, where it makes man its object, it regards him as an animal, as an object external to man. The objects of the sexual instinct, on the contrary, are other human beings. Each sex is so constituted as to desire and enjoy the other. Whereas the organs of taste are the same in all, and all pursue the same objects of gratification, the organs of reproduction are of one kind in one half and of another in the other half of the race, and endowed with an adaptation and an attraction the one for the other. Thus the world is divided into two great halves by this distinction which is called sex. If we look down, at this point, into the lower forms of life, we shall find that a similar distinction pervades every department of biology. Throughout the vertebrate series of animals, male and female exist in separate individuals, and, with a few exceptions, this is also the case throughout the entire animal kingdom, while the distinction of sex also prevails generally among plants.

THE SEXUAL APPETITE.

The sexual desires of male beings are quite different from those of females. Throughout the animal kingdom the latter possess them only at certain times and during a certain period. At all other times they are indifferent and manifest no sexual passion. The males, on the contrary, seem to possess the appetite at all times.* There could be nothing lost and might be much gained by this latter fact. To secure certain fecundation for all females in the proper season seems to be the chief object of nature. That many males are deprived of gratification is a matter of no importance. In such deprivation Nature is as indifferent as she is lavish with her germs of new life. Still, it is certain that the males of some species experience much more passion during the breeding-season than during other periods. This

* Darwin, "Descent of Man," vol. i, pp. 264, 390; vol. ii, pp. 116, 256.

is well proved in the case of most birds, while in fishes there is a male periodicity corresponding to the female periodicity.

Anomaly of Woman's Sexual Sentiments.—In man the same is true of the males as in animals, except perhaps that his passions are even more uniform. But in women the case is somewhat different. Although less bold and aggressive, and doubtless on the whole less intense than those of men, they are yet much less influenced by physical processes than those of the lower animals. Their chief variation is a monthly one dependent upon ovulation, becoming much weaker during the agenetic period. But even then they are often by no means faint. So, too, they continue in most cases throughout pregnancy, often manifesting themselves even more strongly during its earlier stages than at other times. This is all doubtless contrary to the natural state of things, and can only be accounted for as the result of social conditions.

The immense superiority of the two faculties of *reason* and *imagination* in man over what they ever attain in animals would suffice to explain this. In animals, where every thing is done in obedience to impulse alone, the males are unable to excite passion in the females at times when nature does not supply it. They possess no means of reaching their imagination. As all the facts prove, the pursuit of this pleasure by the males is as open and free from restraint as is the pursuit of the gustatory pleasure. All that play of the imagination which secrecy fosters is wanting in them. The females will therefore no more gratify the males when they do not themselves experience desire than they will eat when they do not experience hunger—they are even less likely to do so, for the local pleasures of the tongue and palate sometimes survive though the stomach be completely satisfied, while the temporary disappearance of the sexual desire may be complete. And, when this desire is thus totally absent, the males have no power to arouse it. They can not make their demands understood by the females, and the latter would probably submit to be destroyed by their mates rather than afford them the gratification sought. In the second place, the lower animals lack the reasoning powers necessary to prevail upon the females. They can not practice upon them those arts, and secure, by promises of future rewards of other kinds, present submission to what gives them no immediate pleasure. They are too low in the scale of mind to understand the principle of a *quid pro quo.* They have no foresight, do not know how to provide, to anticipate, to barter for future gratifications in exchange for present ones conferred. They have no language capable of conveying ideas of this kind and exciting hopes and fears of future benefits and evils as inducements to the performance of acts which are, if not distasteful, at least not prompted by interior impulses. All they know is to obey natural promptings, and however much the males may feel these promptings they can not persuade the females to permit their satisfaction unless they experience similar ones.

In man all this is different. He can employ both these grand levers, imagination and reason, to obtain the pleasure craved. He has the power by appealing to imagination to arouse in woman passions which nature does not spontaneously supply. He can excite them at times when they are not needed for the accomplishment of the objects of nature. He can produce them during her agenetic period when there is no fertile principle within her to be impregnated, and during pregnancy when fecundation has already taken place. He employs for these purposes the powerful aid of that social sentiment called modesty, the genesis of which we shall endeavor to trace at the proper time; and by operating behind the veil of secrecy, and arousing all the prurient charms of curiosity, seconded by the material facilities which clothing and houses afford, he is able to gain for woman a complete mastery over her own nature. By appeals to imagination he actually creates the passion which

Nature declares useless and withholds, but which he declares useful for the satisfaction of his own. But Nature is often too strong for his appeals. She often asserts her supremacy, and refuses to allow the great end of perpetuating the race to be placed upon a common level with the base end of fulfilling the desires of the male sex. Man often fails to excite in woman, in her unnatural periods, a reciprocation of his desires. But this by no means daunts him. When appeals to imagination fail, he appeals to reason. If he can not create in her this desire, he takes advantage of desires which are more constant and less capricious. If she can not be made to desire his embraces, he always knows what there is that she does desire, and this he offers in exchange. He employs the art of persuasion, the power of oral communication. He lavishes upon her endearing epithets, gratifying her pride and her conceit. And then he promises her those material gifts and advantages which he knows will constitute the strongest temptation. And in this manner he secures willing submission when nature persists in withholding impulse.

The constant exercise of these influences upon woman from generation to generation has at length resulted in the radical differences which I have pointed out between the human species and the lower animals. It seems to be proportional to the degree of social organization and material prosperity, and this is illustrated in many savage tribes as compared with enlightened nations.

Difference in the Sexual Instincts of Males and Females.—The sexual desire of man is quite different from that of woman. Besides being uniform and uninterrupted, while hers is more or less periodical and intermittent, it is further distinguished by boldness and aggressiveness where we find shyness and timidity in her. This species of natural modesty we find among the females of many animals.* Not-

* The passive character of female creatures, as contrasted with the active character of males, is manifested in the lowest forms of life. (See Julius Sachs, "Lehrbuch der Botanik," S. 870.)

withstanding the mutuality of desire in both, we almost always find the females feigning an effort to escape, and the males pursuing. All this has its counterpart in the human race, where the normal condition universally is, that the males should take the initiative and active, and the females the defensive and passive character in the courtship. The genetic explanation of this may be, at least in part, that the male is always seeking the female, even when she will not accept him, and thus, from the habit of refusing when unwilling, she has fallen into that of pretending to refuse even when willing. Certain it is that this fact is a very important one for sociology, and one which has materially affected the condition of society.

I note these points of distinction between the sexes to show, as occasion may require, in what manner they have affected the character of society and determined the direction of the reproductive forces.

Diffusion of the Sexual Instinct.—Thus far I have confined my remarks to the simple sexual desire by which nature provides that each species of animals, including the human species, shall reproduce its kind. And, so long as man is regarded as an animal, this view is sufficient. For there is no probability that the sexual desires of animals ever diffuse themselves through the system far beyond the local organs of generation. To a certain extent, no doubt, the whole system of an animal is sexually polarized, but the seat of pleasure in either sex is localized. This is the case also with man, and the degree of diffusion is strictly commensurate with that of his mental and moral refinement. But the extent to which these influences are capable of modifying his sexual nature is very great. While the sexuality of a savage is scarcely less localized than that of a brute, that of a cultivated and enlightened man or woman is widely diffused, and blends with all the other emotions and with the intellect itself. It were foolish to deny that the seat and radiating source of all love between the sexes is the generative system. And yet, in a highly organized individual, this sexuality is so thoroughly diffused that perpetual and enduring pleasures flow from the entire nervous system, which are regarded as spiritual emotions. This state seems to be a kind of foretaste of venereal gratification when the latter is unattainable. It is, however, much more than this: it often exists independent of, and unaccompanied by, the localized sentiment.

Love.

In the same manner as the term Want was employed as a general designation of the preservative forces, we may employ as a general designation of the reproductive forces the corresponding term Love.

The word *love* is employed for a variety of quite different sentiments, since modern languages do not possess separate terms for the expression of the several ideas conveyed by the Greek in the three distinct words, *ἔρως*, *αγάπη*, and *φιλία*. It is only in the first of these senses that I shall use the term *love* in this discussion, and that in its primitive signification as employed by the older poets, viz., *sexual love*. But it is wholly improper to restrict this expression to the localized instinct. The love of man for woman and of woman for man, is necessarily sexual, and any attempt to separate the diffused from the localized form, by an abrupt interval, is useless, and betrays a desire to escape the recognition of an obvious fact. All love emanates from the sexual system, of which the mammary glands are a part, particularly in woman, and the higher sentiment of love seems to have its chief seat in the breast of man as well as of woman.

Love is essentially a physical passion, and no matter how pure it may be, or how far removed from the grosser desire to perform the reproductive act, it is out of this desire that all those etherealized emotions originally emanate, and to this that they all must ultimately revert. Nature begets no useless thing. Every thing we find ourselves endowed with is more or less closely linked with one or the other of her great economic ends, with the preservation or the perpetuation of life. The passion of love in its most elevated forms is so indissolubly connected with the latter of these ends that there exist no breaks in its chain. Its final object can never be less than reproduction itself. It is only when we thus regard it that any just conceptions of its nature can be formed. Instead of charging love with impurity because we find it constantly tending toward this object, we should see in this fact only the natural working of a great harmonious law. This truth once fixed in the mind, man will learn to expect the consequences from love which he now so frequently deplores. But the most important advantage which will flow from the recognition of the unity of all the love-sentiments, will be that of raising the standard of those forms which are now called base to the same dignity with those which are regarded as pure. It will be seen that all love is pure, since it is natural; for nature, not convention, is the true standard of purity.

SOCIOLOGIC EFFECTS OF THE LOVE-SENTIMENT.

When we consider the universality and the intensity of this passion, we may well conclude that its influence upon society during the myriads of ages gone by must have been immense. We may well suppose that all human institutions have been profoundly modified by its presence. It is our present task to arrive as nearly as may be at the character and extent, and also at a classification, of the results which have accrued to society from the sentiment of love alone. These results have not only been social, but physical.

Physical Modifications.—The first physical modifications are those which the race has undergone by reason of the preferences of the females. Far back in the primordial ages of man's existence this principle began its work. The extent of its effects can not, of course, ever be known.

Slight variations are always occurring in all organisms. They must have occurred in man. Woman, being the constant object of man's unremitting passion, was placed in a position to exercise a wide option among those who sought to possess her. Thus placed, she naturally chose those whom her sense of the beautiful most approved, rejecting the less attractive. On almost all points this sense was probably uniform, so that the same peculiarities would be preferred by all and at all times. Those possessing peculiarities which pleased the female sex, therefore, became the fortunate founders of new generations. But the universal law of nature is to transmit to posterity the peculiarities of parents. Hence there resulted the transmission from generation to generation of a certain number of variations most pleasing to the female sex, which at length became characteristics of the entire race. It is impossible to determine in all cases what the characters are which have been produced by the operation of this law; but the color of the skin, the growth of hair upon the body, the purity of the complexion, and the regularity of the features, are among those for which science has already adduced evidence. It is not at all impossible that the erect posture of man, by which he is distinguished from all other animals, may be also to some degree a consequence of sexual selection. Indeed, for aught we know, the entire figure of the species may have undergone a complete revolution from this cause.

The second physical alteration which man has undergone, in consequence of the action of the passion of love, has grown out of the rivalry which existed among the males for the possession of the females. Physical strength must have once been the only claim set forth, and he who vanquished all his rivals and secured the coveted prize was thus enabled to transmit the physical qualities by which he was able to do so. Thus those possessing the greatest physical strength and prowess, and the most available weapons of combat, were able to transmit these qualities to posterity, and the weaker ones were obliged to die without issue. The former possession by man of formidable canine teeth as offensive weapons is the most completely established scientific fact in favor of this theory. But the superior strength of the male, as well as his size and courage, may, with equal probability, be referred to this law. It may be, too, that a very large amount of that excess of intellectual vigor, which men are acknowledged to possess over women, should be attributed to this cause, since the mental power—the cunning and sagacity—of the male sex must have been far more successful in circumventing rivals and securing the preferences of the female sex than any external weapons of physical warfare. And all these peculiarities are proved to be inherited to a greater extent by the males than by the females.

It is to that unrivaled scientific philosopher, Charles Darwin, that the world owes the promulgation and substantiation of these great biological laws.

Social Modifications.—But, besides these morphological effects which love has produced in man, there is a long train of purely sociological effects which are ascribable to its operation. These may all be brought under three principal heads: 1, institutions of marriage; 2, the sentiment called modesty; and, 3, the present comparative relations and condition of the two sexes, or, as some may better understand it, the social condition of woman as compared with that of man. Each of these, in so far as they can be considered separately, is the direct and exclusive result of the reproductive passion, sexual instinct, or love-sentiment. To be convinced of this, one needs only to contemplate the impossibility of each respectively, but for that emotion.

MALE SEXUAL SELECTION.

Before proceeding to consider the various forms of marriage, it will be necessary to advert to a very important biological fact which has constituted one of the results of the development in man of his greatly superior psychic faculties.

This fact is what may be called male sexual selection, or the transfer to the male sex of the sexual selective power exercised in the lower animals and in primordial man by the female.

The higher a being rises in the scale of development, the more sensitive become all its faculties and organs. Just as the raw pabulum of animals will not suffice for man, and the rude preparation of food by the savage fails to satisfy the more refined palate of civilized man, so the development and refinement of all the faculties of man in his gradual emergence out of animality into humanity, and his elevation from barbarism to civilization, lead him more and more to select his companions as well as his food, and beget preferences in the objects of sexual as well as of gustatory and all other species of gratification. Much as may be, and doubtless is, due to the effects of the selection of the female sex in effecting morphological changes, it is still to the selection of the male sex that must be ascribed the greater part of those sociological phenomena which belong to the domain of the reproductive forces.

In fact, it is here that is to be detected one of the few distinct and tangible facts which serve to separate man from the brute creation. According to the law just enunciated, by which increased intelligence manifests itself in the direction of the subjection of woman to man, her power of selection, so freely and constantly exercised in the animal state, is taken away, and she loses that supremacy which she formerly held. Then, and throughout the animal world, the female sex controlled the male in all matters pertaining to sex, haughtily declining and successfully rejecting the advances of the latter when not reciprocated. But the female of the human race has lost this scepter, has yielded to the cunning appeals of her male companion to her imagination and her reason, and little by little surrendered both her mind and body to his control. Once she ruled over him by reason of his passion, which prompted him to make perpetual demands upon her for the favor that she alone could confer; now he rules over her body and soul by reason of a thousand desires within her, which prompt her to make perpetual demands upon him, as lord of the universe, for that protection and those favors which he alone can confer. The transition from the animal to the human state has wrought a complete revolution in all the sexual relations, and transferred the selective power absolutely from the female to the male sex. In no other department has there been so great a reversal of natural law.

This important fact of the transition, in man alone of all animals, from female to male selection may not only be plainly seen in its direct results, but is significantly attested in certain of its indirect ones. Among others, it is interesting to observe that, just as the form of sexual selection is the opposite in man from what it is in the lower animals, so, as indeed might be expected, the male beauty, due to female selection in the latter, becomes female beauty due to male selection in the former—a fact which at once affords a striking proof of this transition, and of the modifying power of the selective process.

It is interesting to note that here again, as so many times before, we see in the progress of true civilization the unmistakable tendency toward the ultimate restoration of the primeval state of nature. Once more the cyclical character of our artificial social system is clearly revealed. Even in our own times we are beginning to observe the most unmistakable signs of the eventual resumption by woman of her lost scepter, and of her restoration to that empire over the emotional nature of man which the females of nearly all other animals exercise.

Marriage.

Let us now consider the various institutions of marriage which have existed among men, and the reasons, known and hypothetical, which have led to their adoption. The uniformity and invariability of the sexual desire in man, taken in connection with its intermittent and periodical character in woman, rendered him, as it has the males of all species of animals, the active and aggressive party, even during the periods when woman's passion was as strong as his own. She learned to wait for advances on his part in all cases, and to remain passive under the most extreme desire. This fact becomes therefore a prime element in the entire philosophy of sex, since it reduces the source from which the reproductive forces emanate to the male sex alone. The results are doubtless profoundly modified, as well sociologically as biologically, by the elections and preferences of the passive sex, but the motive power, the propelling force, is in man, whom, when we scan the history of the race, we shall find to have shaped all the facts relating to the sexes pretty much after his own mind. The activities which have been put forth in this department of life, like all other activities, are but a series of struggles for the gratification of desire. Here, as every-where else, pleasure is the object of all action. But in this case, more than in any other, the motive to action is impulsive rather than rational desire, and the pleasure sought an immediate and physical rather than a future or intellectual one. Moreover, the impulse is of a nature which will not brook defeat, and which does not know how to submit to restraint. Upon its strength or weakness depends the perpetuation or extinction of the species, and therefore its intensity is an element in the fitness of the species to survive. The fundamental law of natural selection has increased that intensity to a very high pitch, and endowed man with the most irresistible passions. He must be regarded as the source of power for the accomplishment of all sexuo-social phenomena.

Marriage, in whatever form, is but the successful issue of these efforts. The courtship of animals is but the attempt to obtain temporary gratification. This must have been man's early condition, and the marriage relation was doubtless once limited to a single reproductive act, although in many animals, and particularly in birds, quite a permanent form of marriage exists, often consisting in a mating for life.

The dissatisfaction and uncertainty of this temporary and ephemeral form of marriage must have been felt by man at a very early period, and he must soon have set about the task of devising a more permanent and satisfactory form. The passivity of woman, coupled with the ardor of man, soon placed her wholly out of the account, and reduced her to the condition of a mere possession, liable to fall into the hands of any admiring rival who could succeed in securing and retaining her—this possession differing little from that of any other class of property. This form of marriage by seizure and forcible retention of the wife by the husband may be regarded as one of the first which existed after the state of pure promiscuity. But, like the seizure-method of obtaining other kinds of property, it involved the race in perpetual combat, and rendered existence precarious and social progress impossible. Just as government was instituted to protect society from such ruthless modes of acquisition, so formal marriage was also instituted to prevent these incessant strifes among men for the possession and retention of women.

This parallelism between the progress which man has made in refining and complicating the modes of operation of the preservative and of the reproductive forces may be carried out still further. Thus the higher form of love may not inappropriately be compared to the love of money for its own sake, both of which are derived from the respective simple instincts of reproduction and nutrition; while marriage in its various more complicated forms may be regarded as the homologue of the various legal forms of seizin, conveyance, and tenure of property.

The term *marriage* is used in the general sense of the union of the male and female for the purpose of reproduction. In this sense it is as applicable to any other animal as to man. But the insecurity of this kind of union led man to the institution of various safeguards against the disturbances experienced in his sexual relations. These safeguards took the form of customs, or rites, which society came to respect. Like all customs originating among primitive tribes, those concerning sexual unions were accompanied by ceremonies which were supposed to give them an especial sanction. The number and variety of these marriage ceremonies are endless, and an attempt to enumerate them would be beyond the scope of this work. We are less concerned with these forms than with the general facts connected with the relations of men and women.

PRINCIPAL FORMS OF MARRIAGE.

While the forms of marriage are multitudinous, often ludicrous, and sometimes barbarous, the general methods in which the sexes have united may be reduced to five or six, only three of which, if we distinguish group-marriages from mere promiscuity, are proved to have ever prevailed to any great extent. These three are respectively polygyny, polyandry, and monogamy. Polygyny is the union of one man with several women. Polyandry is the union of several men with one woman. Monogamy is the union of one man with one woman. The first two are embraced under the generic term polygamy, though polyandry, as a recognized form of marriage, has been far less prevalent than either polygyny or monogamy. Another form of polygamy is where the two forms just named are more or less combined and blended together, so that one man plays the part of husband to several women, some or all of whom play the part of wives to several other men. Still another form of marriage has been actually found to exist, in which the union is for a limited time fixed by the common consent of both parties, at the expiration of which both are at liberty to unite with others. Extensive variation is also found in the terms of union in all of these ways, some of which might be classed as separate and distinct conditions of marriage.*

POLYGYNY.

The intensity and uniformity of the sexual passion in man, while they rendered the permanence of the race secure, exerted at the same time a special influence upon the mode of union of the sexes. It was impossible that all men should be able at all times to obtain the gratification demanded by their natures, since woman could not share with them that uniformity of desire. This was particularly the case in the infancy of the race, before the persuasive powers of man had wrought a change in her nature by appeals to her imagination and her reason. It was absolutely necessary for man to abstain, as do all male animals, for the greater part of the time. Upon an average, the number of males in the human race, as in most other species, is equal to the number of females. Therefore, even if all were mated, the desires of the male sex could be but meagerly satisfied. In addition, therefore, to his efforts to overcome, as above shown, the periodical apathy of woman, man sought to secure this gratification by other means. This could not be better accomplished than by the possession of a plurality of wives. Of course, all success in this attempt must be at the expense of other less fortunate men, since, for every wife, after the first, obtained by one man, there must be another man without any wife at all. It became, therefore, a question of power who should possess the women and who should do without them. How far polygyny tends to increase the proportion of females over males, or whether it does so at all, are questions which science has not yet answered. But it is certain that this form of marriage is one which has very extensively prevailed, and still prevails to some extent, even among enlightened peoples, and

* For accounts of a variety of other forms of marriage, see Sir John Lubbock, "Origin of Civilization," chap. iii; Herbert Spencer, "Principles of Sociology," vol. i, part iii; John F. M'Lennan, "Primitive Marriage," etc.

is not without its defenders upon philosophical grounds. It is argued that sexual gratification is not a necessity to man, and that the effect produced by permitting the new generation to be begotten of the most enterprising is a healthful one, and accords with the law of the survival of the fittest. If the premises could be admitted, this argument might be good in itself, but there could evidently be no general system of polygamy without having for its result that the many who were deprived should support the few in the luxury of a plurality of wives. And a still worse consequence would be apt to be the reduction of women themselves to the condition of drudges in addition to that of concubines. And such has doubtless always been the effect of polygyny. But these considerations are never urged in the natural operation of social laws. The great reproductive force pushes forward for the accomplishment of its object, regardless of the weal or woe of society. The passions of men, considered upon the whole and in the long run, are irresistible, and will be satisfied. Every form of power will be brought into requisition, and no regard will be had for the feelings of those who prove unequal in the strife. Let the effect upon society be what it will, the most powerful, in the exercise of whatever form of power is best calculated to succeed, will monopolize the luxury of wives as it does that of material goods, and let the rest go without. The overthrow of polygamy, wherever it has been overthrown, is a mark of progress in abolishing this species of monopoly.

POLYANDRY.

The other form of polygamy, in which several men unite in the possession of one woman, is far from being engendered by causes which are the reverse of those which engender the first form. Polyandry, which is the reverse of polygyny, has by no means had its origin in the successful efforts of women to obtain the gratification demanded by their natures, as the latter has in the case of men. On the contrary, the same cause, operating in an inverse direction, has led to the institution of both these forms of marriage.

Reverting to the fact which we have recognized as the power of male selection, we perceive that in polygyny it operates in the direction of securing for the most influential as large a number as they desire of such women as they regard best adapted to afford them the satisfaction required. And, as, notwithstanding the *de gustibus non*, there does exist a certain natural standard of taste, nowhere more apparent than as thus manifested, the result is the attraction of the most beautiful females into the seraglios of those most powerful in securing them. The holders of political and ecclesiastical power have been the ones most successful in this direction. In all countries where polygyny has been sanctioned, it has been the kings and pontiffs who have enjoyed the greatest number of wives. But in polyandry it is no less male selection than in polygyny which controls the union of the sexes. It is the same preference shown by men for beautiful women which attracts many men to one woman as it is which attracts many women to one man. In the one case, the man is influential enough to obtain exclusive possession of several women. In the other case, none of those who unite with the woman in question has sufficient influence to acquire sole proprietorship over her, and is obliged to be satisfied with a partial one.

As the various tribes among whom typical polyandry was supposed to prevail are more carefully studied, it is found that this form of marriage is less prevalent than had been supposed, and that in its stead there exist various forms of communal marriage and family marriage, in which, for example, a woman must be the wife of all the brothers of her husband. On the other hand, in certain tribes, as in Thibet and Cashmere, where the polyandrous unions are quite definite, it is found that industrial considerations have largely influenced their adoption, since the chief occupation of the men of those countries is the herding of flocks at a great distance from their homes, and polyandry enables each family to leave one male member behind to care for the children while the rest are absent.

But, whatever may be the doubts respecting the practice of polyandry among the less civilized tribes of mankind, there is a form of it more or less typical, which has always prevailed in the highest civilizations as a concomitant of the prevailing form of marriage, whether that be polygyny or monogamy. Though generally condemned, this form of sexual union furnishes important lessons to the sociologist in attempting to trace the natural effects of the social forces irrespective of their moral bearings.

It is probable that this species of polyandry has most extensively prevailed in the same countries where polygyny has most prevailed, and as a complement to it. The absorption by the influential of so great a disproportion of the female population left among the lower classes a corresponding disproportion of males. This would be equivalent to a scarcity of females, and would greatly stimulate the demand for them. That this should result in the frequent union of several men with one woman would be the most natural of all consequences. That it should fail to do so would be quite improbable. But that the men thus sharing one woman should do so by virtue of any mutual compact or understanding, would argue a social state devoid of the sentiment of jealousy. The possibility of such a state is put beyond question by the facts proved to have existed. In either form of polygamy, one sex must abjure that sentiment, and I see no reason why man should not be wanting in it in some cases as woman is in many. We know that, in those countries where a plurality of wives is allowed, they usually regard it as an honor to become one of the wives of a king, and know nothing of jealousy toward other wives of the same man. And yet it is certainly rare that two or more men have openly associated with one woman as a recognized mode of marriage. The fact must be accounted for by the greater independence of the male sex and their more belligerent propensities. It is religion and custom which reconcile woman to her lot, but these influences are less powerful with the male sex.* Hence it is that polyandry has gained so feeble a foothold on society as a legal and authorized form of marriage. Still nothing could avail to abolish it as a prominent social fact. Indeed, in this respect it has played almost as important a *rôle* as any other marital relation. Probably no one of the forms enumerated could have so persistently defied the influences of society and so steadily maintained itself in the midst of other forms having the social sanction, and in opposition both to social and municipal law. As already stated, it seems to have prevailed extensively in the earlier ages when polygyny was the recognized form of marriage, as a consequence of, and as a complement to, that institution. In Greek and Roman antiquity, when the monogamous form prevailed and was alone legally acknowledged, the polyandrous form was so completely winked at that many ladies of good repute and some notoriety adopted it and made no effort at concealment.† Women of both physical and mental superiority became the recipients of the attentions of men of equal standing from all parts, and in these attentions were included all that it requires to constitute marriage. This was especially true in Greece of ladies like Aspasia, who became the centers of literary circles. Under the Roman laws the marriage relations were very lax. All forms of polygamy were for-

* Jealousy is, doubtless, a derivative passion, though one not difficult to account for as a natural result of the original sexual instinct, and, but for the counter-influences of custom and reason, would probably be universal to man at least, if not to certain of the higher animals. With regard to animals, I give for what it may be worth the following observation from my note-book of November 10, 1876, without changing the phraseology: "Witnessed a phenomenon which I interpret as an evidence that the sentiment of jealousy exists among females of the lower animals. There were three hens with a cock; between the cock and one of the hens a successful courtship took place, immediately after which, the successful hen was attacked first by one and then by the other of the two unsuccessful ones and driven away to some distance."

† Lord Kames, "History of Man," vol. ii, p. 50.

bidden, but both polygyny and polyandry prevailed without general reprehension, particularly the latter. And when the church assumed control of marriage, reduced it to strict regulation, and placed it under constant surveillance, prohibiting bigamy and polygamy under heavy penalties, it succeeded in little more than driving the polyandrous system into darker regions and investing it with a baser and more criminal character. Instead of its being the beautiful and attractive who offered themselves to any whom they found congenial, it became the poor crushed victims of this social rigidity, who, as outcasts of society, were compelled to gain a livelihood by prostitution, which is a modified form of polyandry.

And this is the state of modern society. This system of polyandrous marriage exists every-where, to the knowledge of every body, and yet it receives neither legal nor social sanction. As a consequence, it must be a very low form, and entail evil upon every new generation. Any thing will become base if it is placed under the ban, and to this monogamy itself would form no exception. Whatever must be done secretly and clandestinely will be done improperly and become an evil, though it possess no intrinsically evil elements. Society declines to recognize the irrepealable laws of nature, one of the most persistent of which is that by which the sexes demand and seek each other. No human regulation can check this. The reproductive forces, developed and adapted to secure the perpetuity of the race, are always in operation. Society professes to provide for the greater part of the cases by sanctioning monogamous unions. But there remain, and there must always remain, a vast multitude for whom this provision is not sufficient. It would be impossible for society to guarantee the monogamous marriage of all its members. The human race has grown so fastidious, that it is not every man or woman that can find a suitable life-companion. The sentiment of love has become so delicate that it requires a certain degree of correspondence in all kinds of qualities to make such unions desirable or even tolerable. Again, there come in so many pecuniary considerations, which form barriers to marriage, that thousands who would gladly do so, do not feel ready to take so important a step, especially as women are usually non-productive, and would require to be supported by the labor of their hands. In these and many other ways it happens that society is constantly filled with men and women who have no legal access to one another.

Modern society assumes, firstly, that all can marry if they will; secondly, that where they do not, it is because they have no attachments for the opposite sex; and, thirdly, that all can abstain.

Each of these assumptions is either absolutely or, in some qualified but legitimate sense, objectively untrue. As to the first one, we have seen that it is a physical necessity that many remain single, and a moral necessity that many more should do so. In cultured communities, a want of congeniality deters great numbers from marriage. The keener the sensibilities, the greater the necessity for a manifestation of the higher form of love. In all countries at all advanced in culture, this sentiment has existed in a form so far removed from the localized instinct that those who furnish the romantic literature of every people scarcely recognize their connection, and there has come to exist a general disposition to regard them as quite independent. The received theory of the sexual relations ignores the more elevated sentiment as not possessing any tangible reality.

Sexual desire is certain to be a concomitant of love in the higher sense, although the reverse is by no means necessarily true. It is certainly a remarkable fact that some people spend the greater part of their lives without ever experiencing the elevated form of love. The theory, that for every one there exists somewhere one, and only one, perfect sexual counterpart, romantic as it is, is unfortunately refuted by the common experience of two or more equally true and genuine attachments in one life-time. Young people usually succeed in finding companions in their own neighborhoods, no matter how limited these may be, as is found to be the case among the sparse pioneer settlements of new countries. How much better they could have been mated had they possessed a wider field to select from can never be known. As a general rule, it may be assumed that the sexes will join with each other wherever they meet under the proper conditions of age and circumstances, that in populous districts love is more selective and fastidious, and that the more intelligent the community is the more definite will be the sentiment. It is therefore among the most cultivated that we find the greatest number of those who have declined to marry, because they have not yet found those of the opposite sex for whom they feel a sufficient attachment.

Another equally great barrier to marriage is the failure of one of the parties to reciprocate the feelings of the other. It often happens that a man will form an inalienable attachment for a woman, or *vice versa*, without the other experiencing any responsive impulse. Persons often live single a whole life-time because they are unable to obtain the only one in the world for whom they can ever experience a throb of pure passion. This may be occasioned by other causes than want of mutuality. Parental opposition, the previous marriage of one of the parties, difference in social station, and a variety of other causes lead to the same result, and prevent marriage.

We see then that this more diffused and elevated form of love becomes at once the greatest incentive and the greatest barrier to marriage. It differs wholly from the localized passion in being *selective*. While it is less selfish, it must be called out by, and exclusively directed toward, one definite object. From this circumstance it may be called the *objective* form of love. No other than the particular person loved can claim any share of it or awaken any new expression of it. At the same time it rather strengthens than diminishes the physical desire. Such as have once had it called forth are justified in declining to unite for life with any other than those for whom it exists. Those who have never felt it can not be blamed for not regarding the lower instinct a sufficient ground of marriage in this permanent form. And thus the passion which can alone make such a marriage worth its sacrifices is constantly holding in celibacy thousands who, but for its power, would enter the connubial state.

The second postulate of the theory referred to, viz., that those who do not marry do not love the opposite sex, and have no right to expect the gratification of sexual desires, is defeated as to its first term by the considerations just urged. For, as we have seen, it is those who love most and most faithfully who find it most frequently impossible to marry. With respect to what men have a right to expect, it seems evident that society has no voice in these matters. Every one has a right to seek the gratification of any and all of his desires, so long as in so doing he does not prevent others from exercising the same right. If society interferes, it should be from a scientific or sanitary, and not from an abstract moral, point of view.

The third assumption, viz., that any one can abstain under all circumstances, is the one most of all out of consonance with the facts of experience. But, then, it is founded on the free-will doctrine, and is only as true as that doctrine itself. What do we mean by being able to do any thing? Certainly a person can do under some circumstances what he could not do under others. But can he always control his impulses under all circumstances? Manifestly not. When men yield, it is because the combination of influences without and within compel them to yield. But there is no limit until we broadly admit that every act is thus irresistibly controlled (see Chapter XI).

An appeal to the facts themselves will be more interesting at this point, if not more conclusive. As a matter of common notoriety, persons not legally joined to those of the opposite sex do not all abstain. Whatever the circumstances may be which impel them, they do yield. It is not enough to assert that it is only the bad and depraved who do this, because it is not true. It is not claimed that every one yields, for every one is not tempted, every one can not find an object of union. Yet, let the inducements and opportunities be held out, and all are liable. We all know how the celibate clergy were in the habit of breaking this fast, and how mercifully they were induced by their own experience to deal with this class of offenders against the canonical code.*

Sociology has to deal with the positive phenomena of society, and takes no notice of what men's ideas are as to what such phenomena ought to be. It is from this stand-point that this question must be viewed. It is the lower classes of society that can be most easily studied. The less the psychic prevail over the physical influences, the simpler and more apparently regular the phenomena become. Legislation will be scientific, and therefore effective, in proportion as it approaches the stand-point of the sociologist, and recognizes the actual phenomena that occur while displaying whatever wisdom it possesses in the direction of rendering the facts harmless or advantageous.

Polyandry, therefore, while it is the form of sexual union least recognized by man, and least sanctioned by any form of law, is, at the same time, the form which, in the nature of man, must exist to a greater or less extent, whatever may be the acknowledged and legalized form of marriage. Men who have no legal access to women will seek illegal access to them, and will obtain it at any price within their reach. This, in political economy, would be called a demand. And here, as certainly as in trade, demand will create supply. Under the reign of polygyny the demand is at its greatest. Therefore we find, in Hebrew writ, frequent reference to harlots and whoremongers in the land of David and Solomon, with their numerous wives and concubines. In con-

* Blackstone's "Commentaries," Book iv, p. 65.

nection with monogamy, polyandry comes in to supply its imperfections, as it does to complement the one-sidedness of polygyny. Exactly to match the whole human race would be impossible, if all individual predilections were set aside, since in no community is the number of adults of both sexes the same. There would still remain an excess of one sex or the other. The exigencies of life, the flow of population, the conditions of various parts of the world in favor of one sex or the other, always cause such an excess as the result of local influences. In new countries the males always exceed the females. In old countries the reverse is the case. Population is never exactly divided between the sexes. Still, this is as nothing compared to the other causes of celibacy to which reference has been made. The worst feature of the form of polyandry which we have been describing is its mercenary character. This is due to two causes. The first is the fact that the demand comes principally from the males. The second is the dependent condition of women. These two facts conspire to produce the result. Insatiate man seeks indigent woman. Each has the means of supplying the demands of the other. What more natural than that an exchange should be made? And this is, in plain terms, the true character of the so-called "social evil." No belief is more false than that woman prostitutes herself to any extent to satisfy her own sexual desires. But, as we shall see presently, she is wholly dependent upon man for the means of subsistence, and is obliged to barter her virtue for a livelihood. For life is dearer than virtue, and there is often more true virtue in this surrender of virtue than there would be in preserving it.

MONOGAMY.

The remaining principal form of marriage consists in the union of one man with one woman. Incomplete and inadequate as monogamy certainly is, it is nevertheless, as must be confessed, a far superior mode of sexual union to either form of polygamy. It is the form which has recommended itself to all the most progressive and enlightened civilizations. Although the natural tendency of the race is toward polygamy, as a result of the grasping character of men, just as it is toward monopoly of goods, still, the jars, discords, and derangements which it occasions, by their perpetual occurrence and intolerable annoyance, have compelled the compromise of monogamy, just as the perpetual strifes arising from avarice compelled the adoption of a fixed code of proprietary rights. Both these institutions are marks of progress in the development of individual liberty and emancipation from the rule of might. The development of the more elevated objective form of love has been favorable to monogamous unions. The affections once fixed upon a single object, the thought of a plurality becomes repugnant. Pure love, as it exists now, is incompatible with polygamy; at least, it does not appear to be in the nature of this passion to have more than one object at once. The localized passion may seek satisfaction from various sources; but the spiritualized passion is true to one object. Both of these passions may possibly exist together and result in polygamous unions; but this is not of common occurrence. It is not maintained that one person may not truly love more than one of the opposite sex, or that this might not be, under certain circumstances, a still higher and more disinterested sentiment than the exclusive devotion to one; but, if it is possible, it is exceedingly rare, and belongs to an age in the future when the sentiments now current shall be greatly changed.

In view of the numerical equality of the sexes, monogamy can not but claim the highest place among the forms of marriage. It certainly comes nearest to supplying the demands of all, and best comports with the conditions of social life. It saves the husband from impoverishment to support his family, and prevents the wife from being made a drudge. It obviates jealousies better than any other form, and secures to lovers the purest and most perfect fruition of their higher emotions. If it curtails somewhat the amount of indulgence craved by man, and subjects woman to unsolicited embraces at unnatural periods, these are but the evils which must needs be under any artificial system of social organization. The first of these evils, or at least deprivations, is far greater among animals, while the second does not exist. Artificial institutions of marriage seek to avoid the former, and tend to increase the latter. Polygamy accomplishes, so far as it can be made to prevail, the first of these objects, leaving the other nearly in its natural state. Polyandry carries the latter evil to its maximum, without necessarily affecting the former. Monogamy is a compromise between the two. The superiority of polygyny over polyandry is due to the circumstance that the enforcement of unsolicited union in the female is a greater strain upon nature than the deprivation of gratification in the male. The first is the greater evil, because a greater violation of physical law. The monogamic compromise does not seem to carry the former evil beyond the power of the system to habituate itself. Still, it opens a grave question for the attention of hygienic students.

GENERAL REMARKS ON MARRIAGE INSTITUTIONS.

I have thus briefly glanced at the subject of marriage as one of the primary consequences of sexual desire. In any and all its forms it stands as a simple expression of the natural law of sexual attraction. It exhibits so many modes in which desire seeks to obtain its legitimate object. The variety which it presents in man is no greater than what we see in the lower forms of life, and, when carefully compared, is found to be astonishingly similar, although the erection of each of these forms into an institution is a fact peculiar to the human race, and it is to this fact that must be ascribed those violations of the natural order which are so apparent in society. In man we see every-where, as we do not in animals, those unmistakable evidences of the victory of desire over utility, of the subordination of the grand object of nature—reproduction—to the immediate object of man—

pleasure. These are what stamp all human systems of marriage with an artificial character, and show, in the clearest manner, that something more than the unintelligent laws of natural selection has been at work; that an intelligent power, that of reason and imagination, has been exerting its designing and creating influence in the work of establishing these institutions. In a word, it is in the human race alone that we see in marriage institutions, as indeed in all others, evidence of teleological design standing out in bold distinction from the genetic adaptation and evolutionary development of the extra-anthropological universe, and always displaying itself in this same direction of supplying a human instead of a natural utility, by subordinating function to feeling.

Genesis of Modesty.

Before it is possible to proceed further with the consideration of the sociological results wrought by the reproductive forces, it is necessary to obtain a glimpse of that important artificial creation which is denominated *modesty*. I have several times hinted an intention to offer an explanation of this exceedingly peculiar and wholly anomalous sentiment so universal, at least to a certain degree, in the whole human race, and so totally wanting throughout the universe below it.*

In the natural order of things, the existence of a desire is sufficient to prompt an open effort at gratifying it. It makes no difference whether it be the desire to eat or drink or perform the act of reproduction. All desires are alike before nature—equally pure, equally respectable. All are performed with the same freedom, the same publicity, the same disregard for appearances. Nature knows no shame. She affects no modesty. The acts which are necessary to the

* Sexual modesty is alone here considered. Among many animals, especially domesticated ones, the quality called neatness often amounts to a species of modesty, but the principle underlying it is wholly distinct from that on which sexual modesty is founded.

perpetuation of a species possess no special quality which distinguishes them from those necessary to its preservation. There is nothing inherent in the desires which prompt these acts that gives boldness to the one or shyness to the other. All are alike, co-ordinate, equally essential, equally proper. There is no natural reason for feeling ashamed of the one which does not equally apply to the other.* This natural homogeneity finds a perfectly free expression throughout all the departments of nature below man, and the departure from it among the human races bears a certain ratio to their degrees of artificial development. We must therefore look in this developing process for the origin and the cause of the distinction which civilized man draws between these classes of desires and the acts which they call forth.

In order better to trace this sentiment, we must go back in imagination to the time when man was still in his animal state, in which, as in all his contemporary species, no such sentiment as shame for any act prompted by nature existed. The first consequence of his intellectual superiority, as already shown, was to take from woman her power of selection, and to deprive her of her right of refusal. This surrender on her part was made in response to his appeals to her imagination and to her reason. All this tended to place woman more and more absolutely in the power of man. Long before any proper civilization had begun, the subjection of woman was complete, and sexual selection was transferred from the female to the male of the human species. Marriage, which had previously consisted in simple and promiscuous pairing for momentary gratification, came now to consist in something like the permanent possession of one or more wives by one man. This possession was acquired, like that of other goods, by forcible seizure or something equivalent to this. It was in this act of getting possession of women that those desperate struggles were made which ultimately resulted in the development of canine

* Auguste Comte, "Philosophie Positive," vol. iv, p. 446, note.

teeth and other organs of secondary sexual selection. The most beautiful females were most admired and sought, and for these many rivals would contend. No history will ever describe and no poet recount the battles which have taken place between these rivals for the possession of the fair daughters of the forest and the wilderness. The victor at length seizes his bride and hies away to his chosen resort, bearing his well-earned prize. He dares not remain and seal his courtship in the presence of his enemies. He must steal away and commit in secret the act, for the right of whose performance he has so desperately fought. The case of one is the case of all. The marriage ceremony becomes an elopement. The cohabitation of male and female becomes a signal for attack. All intercourse between the sexes must be had in secret. The state of society required it, self-protection demanded it. The force was strong enough to overcome the hardship, and the propagation of the species went on. But the practice of stealing away to some solitary spot, where no rival could disturb the enjoyment of this pleasure, grew into a regular and permanent custom, and like all customs was continued after the cause which originated it and made it necessary ceased to exist. That cause was fear, and therefore fear may be safely regarded as the sentiment which lies at the bottom of human modesty. Fear of being circumvented and prevented from consummating a pleasurable act otherwise entirely natural and proper—this was the originating cause of modesty. We see something approaching it in animals. The rivalries of wild animals, could we fully comprehend their effects, would show us some of the first steps in the direction of establishing such a custom as that which grew up among men. Breeders of domestic animals doubtless daily observe tendencies in this direction. Every one has observed them among poultry. Where there are several cocks, they seek to separate their chosen mates from the rest in order to enjoy perfect immunity. When this precaution has not been sufficiently well taken, they are frequently attacked by rival cocks, and their pleasure intercepted. It is due to the nature of the pleasure itself that these consequences result. It is in no manner due to the quality of that pleasure or any intrinsic criminality attaching to the act itself. Under the same conditions the gratification of any other desire, the enjoyment of any other pleasure, would be ultimately followed by the same results, and gradually engender the same sentiments. But no other desire partakes of that personal character; no other desire is gratified so much at the expense of others; no other desire depends so much upon the will, choice, or election of individuals; no other desire possesses the quality of enduring indefinite disappointment or almost indefinite indulgence, without resulting in death or satiety. Certain predatory animals seize their food and carry it away from their companions and eat it in secret, in order to secure immunity from the attacks of others. This practice might have placed the pleasure of eating under the ban had it existed in man, although it could never have gone to the same lengths with him as in the other case, since in times of plenty all would have been satisfied, and since, also, the co-operation of all was required in the production of subsistence. There is nothing analogous in the two acts or the two desires. And the same may be said of all the other desires. The sexual desire stands alone as being capable of genetically evolving the sentiment of modesty, and this only in a being endowed with a highly complex and sympathetic organization. The sentiment of shame, as employed in this sense, is a delicate and refined sentiment. It has gone so far beyond its originating cause as to have left it almost unrecognizable. Who would suppose all the secrecy in sexual matters, which society enforces, to be the result of the fear of being disturbed by rivals? *

* I am aware of but one other attempt having been made to account for modesty, and this is that of Schopenhauer, whose theory is that, as life is a misfortune, its perpetuation is necessarily a crime. The performance of the reproductive act is therefore instinctively felt to be a wrong against society: "Voyez

But, if proprietary protection was the foundation of modesty, it does not constitute the whole of its superstructure. Other elements soon entered into it which have imparted to it its peculiar character. The progress of general physical development in man gradually softened and modified all human sentiments, and gave rise to many other derivative or compound ones, all of which exerted a mutual influence upon one another. The idea of *propriety* in general was growing up from a variety of sources. The essence of propriety is conformity to custom. Proper conduct is wholly distinct from reasonable or just conduct. That is proper which is in conformity with established usage. But no fact is more clearly taught by history and ethnography than that there is no necessary relation between custom and either reason or justice. The sentiment of shame in general had no existence until there had been established fixed customs.* Shame itself, a wider term than modesty, is simply regret at having violated a custom. But regret may be ultimately defined as the fear which is experienced of the consequences of an improper act. Shame, therefore, is only a form of regret. It differs from other regrets in the quality of the penalty. In ordinary regrets the consequences feared are physical, or at least possess only an intellectual quality, resulting from negligence or inability to foresee them. They are often serious and extremely detrimental to temporary interests. The consequences of shameful regrets, on the contrary, possess a *moral* quality. They are the consequences of having violated a custom (*mos*). They are not physical, since custom is only a form, and can not wield any mechanical force. They are not intellectual: the rational faculty is not called

ces deux êtres qui se cherchent reciproquement du regard: pourquoi le mystère dont ils s'enveloppent? pourquoi leur air craintif et embarrassé? C'est qu'ils sont deux traîtres qui se cherchent ainsi du regard pour continuer la vie, pour revivre dans un autre être."—(Léon Dumont, in the "Revue Scientifique," 7 septembre, 1872, p. 220.)

* The Greek word δίκη in the course of its history passed through all three of the senses, custom (*mos*), legal right (*jus*), and moral right (*fas*).

into requisition. They are not material, or serious, or detrimental—at least, not directly—to temporary interests. They consist of a purely emotional pain and disagreeable state of the feelings for having violated an established usage. To probe the question still deeper, the exact interest whose injury is apprehended is self-esteem, or rather the esteem of others. We see how far along the social influences must have gone before the sense of shame could be generated. Love of self must have become capable of soliciting the good-will of others in society. Customs must have become so firmly established that to violate them threatened to destroy that good-will, and the loss of that esteem from others must have come to be regarded as one of the most terrible punishments which it was possible to suffer. We may, therefore, safely assume that the pure feeling of shame, of whatever kind, must have been developed after man had become, and had long remained, an intensely social being.

Now, modesty was one of the earliest forms of shame. The institution of marriage in some form, *i. e.*, the custom of appropriating the females, was one of the first of human institutions. It was a necessary condition to the social state. Without it the universal warfare among the males would have rendered all efforts at social protection nugatory. Its establishment secured man's personal safety. It had become a permanent custom to screen the conjugal act absolutely from public gaze. To violate this custom had grown to be regarded as a gross departure from the rules of social conduct. Hence any accidental breach of this canon instantly excited the fear of being despised by those who observed it, and was followed by that kind of regret at having committed the impropriety which took the special name of shame. And the constant vigilance which men and women kept over this matter was called modesty, which, to this day, is measured by the degree of that vigilance.

It is very probable that the impropriety was for a long time confined to the open indulgence of the sexual act itself. It can not have a much wider latitude among those savages who wear little or no clothing. But the introduction of clothing has given an entirely new cast, and an immensely extended range, to the sentiment of modesty. Nothing could be more natural than the passage from the custom of concealing the act of reproduction to that of concealing those parts of the body most directly connected with that act. Hence it is found that the first clothing is always applied to the loins. The story of the "fig-leaf" has its realization in scores of savage tribes dwelling in the tropics, where clothing is scarcely a necessity. And here the question arises whether necessity or propriety had more to do with the extension of clothing to the other parts of the body. I have already touched upon this point (*supra*, p. 557), and will here add that the mere consideration of propriety would not perhaps have alone suggested and established the custom of clothing even the loins. Still, if such is the case, that custom can only be explained by supposing those races among which it prevails to have once clothed the entire body, and afterward, from migration into warmer climates, gradually discontinued all but what was necessary to cover those parts.

The clothing of the entire body except the hands and face, which became a necessity as soon as any nation crossed the tropics, soon rendered improper in various degrees the exposure of all parts of the person habitually concealed. The hands and face would have suffered the same fate but for the obvious disadvantage in keeping them clothed. A near approach to this condition is found in some countries where the women go perpetually veiled. A Turkish lady is said to feel great shame on being perceived unveiled, and this is sufficient to prove that the sentiment is purely conventional, and depends altogether upon the custom prevailing in any particular country. Nothing is so despotic as fashion. It can condemn any thing or it can sanction any thing. And, although all its laws and decrees must have once had a genetic cause, very few of them can now be supported by any adequate reason.

The degree of refinement to which modesty has been carried in the most enlightened countries is amazing when regarded from a purely rational stand-point. Like most time-honored institutions it has outlived much of its usefulness, and now certainly presents a serious obstacle to the progress of rational development. Like all other such institutions, it is the refinements and exaggerations of the original which do the chief mischief, and not the nucleus itself which was generated out of social conditions and social needs. It would be difficult to see how any great harm could well grow out of the original custom of concealing the act of reproduction. The fact that men and women are constantly committing a pleasurable act, which they seek only to conceal from the coarse gaze of others, casts a charm over society which no doubt really increases the sum of human happiness. It doubtless exerts a refining and elevating influence upon both sexes and all classes. But what shall we say of a custom which forbids parents from instructing their children in the most essential matters connected with their social and physical existence? What of a custom which excludes women from classes where the physiology of their bodies is explained—women who, far more than men, are sacrificing their lives by thousands on the shrine of other fashions, because they do not know how they are made?

We have thus endeavored to trace this remarkable sentiment, this mass of absurdities and irrationalities which men call modesty, back to its origin in natural social causes, wholly explicable from the data which our knowledge of human nature and human history furnishes. To the superficial observer such an explanation indeed seems impossible, and it is no wonder that the mass of mankind believe that modesty, with all its kindred sentiments and customs, is a natural attribute which has always existed as now.

Condition of Women.

We are now prepared to consider, as a connected whole, the general result upon the sexes, under the operation of the social system, of the reproductive forces, and to inquire more particularly into the present social status of the sexes, and the causes that have produced it. Confining ourselves, as before, to those effects which must be ascribed to feeling—*i. e.*, to the desire itself—and omitting all social facts which are exclusively due to function—*i. e.*, to reproduction itself—we are to inquire which of the more prominent features of the present sexuo-social system are referable to this class, and how they have been developed during the ages of vicissitude through which the race has passed.

BIOLOGICAL EFFECTS.

Reference has already been made to the facts under this head which belong to biology, and we have seen how profoundly the race has been modified in many physical aspects by the influence of what Mr. Darwin very aptly denominates sexual selection. Man has doubtless undergone as great modifications of this kind, both primary and secondary, as other animals, and not only in his animal state, when this selection was done by the female the same as among other species, but since the dawn of manhood, and after this selection, under the operation of a higher intellectuality, had been transferred to the male sex.

There is at least one important physical transformation which, I think, all will agree should be assigned to this latter comparatively brief period. I refer to the menstruation of women. I do not mean the fact of menstruation, but the peculiarity of it as compared with that of other animals. Few thoughtful physiologists will contend that the laborious and debilitating process by which women, even of the lower races, develop their ova, is natural to the human species. That it has become naturalized, so that it is regularly inherited and constitutes no actual diseased condition, is doubtless true, but it is difficult to believe that the original ancestors of the human race in their primeval state could have formed such a remarkable exception to the rest of creation, and been compelled to suffer under such a "curse." Ordinary sexual selection by the female could scarcely have had a tendency to bring about a result of this kind, since, as long as the choice is with her, no violence would be done to her system. It is, therefore, most reasonable to suppose that the present painful process is the result of the surrender of this right of choice, and the subjection of her person to the excessive attentions of the male sex. This change, which must at one time certainly have taken place, was one of the most thorough and fundamental to which the sexual system could have possibly been subjected, and, although no one could have predicted precisely such a consequence, a far more radical and sweeping one might have been reasonably expected. However wide of the truth the above theory may be, it is, as an attempt at rational explanation, certainly superior to the current theological one.

SOCIOLOGICAL EFFECTS.

But, aside from the physical results which may have been brought about by the free action of the reproductive forces under the guidance of a strong rational faculty, the social results are sufficiently well marked and interesting, and it was to these that I had proposed to confine the discussion.

If we take a general view of our sexuo-social system, we find men and women living together under special and peculiar rules of conduct, occupying separate spheres of activity, and subjected to separate and distinct social conditions. In a word, we find that society has erected a high barrier between the sexes, so that, although they live together, meet each other constantly, and appear to be companions, they are in fact dwelling in separate elements and on different planes.

SEXUO-SOCIAL INEQUALITIES.

It is this general inequality which exists in the social position of the two sexes which especially interests us at present. It is too striking to be overlooked in an inquiry into the conditions of social progress, and, although a portion of it may be regarded as but the natural correlate to their physical inequality, the greater part must be accounted for in some other way. The inequalities which society has established between the sexes may be variously classified. The principal ones may be approximately ranged under the following heads: 1, inequality of dress; 2, inequality of duties; 3, inequality of education; and, 4, inequality of rights. Let us glance at each of these inequalities separately.

Inequality of Dress.—In all civilized countries the men dress differently from the women. There seems to be a tendency in society to separate the sexes by some distinguishing mark which enables people to determine the sex of one another at sight. Nature has done the same thing, it is true, through selection. The plumage of birds and the fur of animals are usually different in the males from what they are in the females. Mr. Darwin offers a very ingenious explanation of all this. So the physical appearance of the sexes in the human species differs in many important respects, only a few of which are explainable by their different habits. The absence of the beard in woman and the difference between the male and the female voice are among the best marked of these physical inequalities. Difference of stature, complexion, physical strength, and intellectual vigor may all be more or less satisfactorily accounted for by the difference in their respective social conditions and life, either as imposed by nature or by custom. And man has sought to imitate nature in this respect by clothing the sexes differently.

It is not probable, however, that the custom of dressing one sex differently from the other grew out of any attempt to copy from nature, and the process was certainly wholly unlike the selective processes of nature. If we will examine the matter closely, we shall discover that the dress of women resembles in its general design that of uncivilized races far more than does that of men. It is more as both sexes originally dressed, before the art had been improved upon and adapted to practical wants. Modifications and refinements in the dress of women took the direction of embellishment, while those of men tended toward utility. And thus, while the demands of active life have worked out for man a comparatively convenient and at the same time comely habit, the conditions which surrounded woman, while they have made clothing a means of loading her with ornaments, have left her in the same or in many respects in a worse condition, as regards her adaptation to active usefulness, than in the beginning. Nor has it been altogether because she has been inactive and useless to the industrial world that her mode of dress has not been improved, for she is generally compelled to perform her full share of the labor, especially of the lowest and most purely physical forms of it. It is due rather to her dependent and subordinate place in society which rendered her incapable of making innovations in behalf of her own sex.

The inactive state of the women of the middle and upper classes, however, is doubtless in great part produced by the inconvenient and unmanageable character of their dress; and the refinements which the rich, and some not so rich, have learned to load themselves down with, are the cause of an enormous amount of disease and suffering, and threaten to work a permanent physical deterioration of the race. The dress of men is not in all respects what it should be, but that of women is certainly the disgrace of civilization.

Inequality of Duties.—Next with regard to the inequality of duties. Independently of the duties of maternity, the sphere of woman's activity is wholly different from that of man's. If we grant that there is a certain natural connection between the bearing of offspring and the care of the household, which is probably true, there remains a chasm to be filled in order to equalize the duties of the two sexes. Among savages it is usually the women who perform all the real work of their societies. This they do in addition to their maternal and domestic duties. Among the lower classes of so-called civilized society, the case is almost the same. In Germany, women till the soil and tend the flocks, as of yore. Nearly all the menial service in Europe is performed by women. In our large cities thousands of women toil to support families, including often their indolent and inebriate husbands. Go into the great factories and see what proportion of the operatives are women. Consider the thousands of women who make their living, and a very scanty one, by their needle. Yet the most of these have their domestic duties to perform in addition to this labor. We see, then, how false is the assertion that men perform the labor of support, while women confine themselves to maternal and domestic duties. Women who profess to confine themselves to these duties usually seek in every way to escape them, and render themselves unfit to perform them by their devotion to fashion. This is because society has established two arbitrary sets of duties, and insists that woman can not perform the one and that man should not perform the other. This fact alone is a proof of the inferiority which society ascribes to woman, since it assigns her duties which it confesses are beneath the dignity of male labor. At the same time every attempt made by the more courageous of the female sex to encroach upon the domain of man, and seek to perform the duties which he has assigned to himself, is met by the chivalric remonstrance that men's duties are too severe for the delicate constitutions of the mothers of the race! Now, all this is excessively transparent and false, and indicates that it is not nature at all, but society, that has assigned to woman her duties.

If the delicacy of the female constitution is an objection to the admission of women to the harvest-field and the machineshop, it is equally an objection to her admission to the laundry and the factory. If maternal and domestic duties are all that women can attend to in England, why can they attend to agricultural duties in Germany, pastoral duties in Switzerland, and mercantile duties in France? It will not be said that in these countries the men perform all the household duties.

But it is claimed that woman should by nature preside over the in-door interests and man over the out-door ones. This is probably the most fatal dogma to the health of woman and to the physical condition of the race which can be found in the whole social creed. It is in effect to assert that nature has designed woman to breathe carbonic acid and man oxygen; that sunlight is poisonous to woman, but exhilarating to all other animate beings; and that physical exercise, which is so necessary to the health of every other living thing, is fatal to the female portion of the human species. It is to make woman, in regard to her place and her duties, as she is made in regard to her dress, an entire exception to all the rules of hygiene. If this vicious dogma that woman's place is in the house is persisted in for a few more centuries, there can be no escape from a general physical and intellectual degeneracy of the whole human race.

Inequality of Education.—The third and not less important inequality between the sexes is that of education. Not content with shutting woman out of all opportunities for gaining knowledge by experience, society has seen fit to debar her also from the knowledge acquired by instruction. She has been pronounced incapable of coping with man in intellectual contests, and it has not, therefore, been thought worth while to provide her mind with any considerable amount of information. It seems to have been regarded as fitting to have woman's fund of knowledge correspond in quantity to the variety of her duties and be characterized by the same limitation. Her knowledge from instruction has, therefore, only kept pace with her knowledge from experience. Ignoring the important truth that all instruction is profitable to society, ignoring the fact that most of the knowledge imparted to men by educational processes is wholly within the capacity of women to acquire also, society has established schools and school systems for the education of the former, leaving the latter in their natural state of ignorance. Deprived, therefore, for ages of all facilities either of experience or instruction, woman presents herself to the wisdom of this age as a dwarfed and inferior being, destitute of both intellectual energy and intellectual aspiration. For it is in these two respects that her inferiority is chiefly manifest. It is these that produce originality and independence in intellectual labor, and it is originality and independence which distinguish masculine from feminine thought. Granting, as we probably must, with Herbert Spencer, that the gestative process and that of supplying nourishment to infants are at the expense, to some extent, of the intellectual as they certainly are of the physical strength of women, it is certain that, in view of the social condition of woman in the present and in the past, the difference now, however fairly shown to exist, between the intellects of the sexes, can by no means be taken as a criterion of their true relative merits. The fact that, wherever the youth of both sexes are permitted to vie with each other under equal circumstances, no marked average inferiority is observed in the females, is one of vital importance, and proves far more than the other fact that the males are more likely to distinguish themselves in after-life, since in women the spirit has been crushed and the opportunity denied.

Inequality of Rights.—Lastly, we find an inequality of rights. And here, as every-where else, this inequality exists to the advantage of the males and to the disadvantage of the females. In all civilized countries the laws have been framed so as to discriminate severely against the personal and proprietary rights of women. Both in civil and political affairs they are usually without redress and without voice, and in the legislature they have always been without representation except by men, while in countries where representatives are chosen by suffrage, this simplest but most valuable of all rights has been persistently withheld. It is as a citizen that woman's position has reached its lowest and most dependent state, she being literally ignored in all matters relating to law or government.

We see therefore, generally, that, whether it be in matters of dress, of labor, of education, or of right, it is the female sex which has had to suffer from the discrimination. The clothing of the male sex is better, more convenient, more comfortable, more healthful. The duties of men are more agreeable, more dignified, more varied, and more interesting. Man's education is more general, more thorough, more profound. The rights of men are comparatively ample, liberal, and manifold. These are facts which, though they may bring the blush to the cheek of a truly chivalrous man, possess the highest interest for the thoughtful and philosophic student of society.

Genesis of Sexuo-social Inequalities.—But it was not to deplore them that we have brought them forward in this place. It was rather for the purpose of inquiring into their causes, and establishing if possible a genesis of their existence in society. The first step in any investigation is the discovery and recognition of the facts which bear upon the subject of it. In social matters these facts often stand out in full view without being recognized. The power of custom and the bias of conservatism make us all blind to their existence. The tendency to convert custom into right often makes those facts appear just and equitable which are unjust and despicable. The fear of losing what is good blinds us to what is bad, and men often cling to the very system which makes them its victims. It is thus that society, which includes both sexes, remains incapable of recognizing the patent fact that one sex is in a condition of inequality with the other, that woman is dependent upon man, and that the female sex is in a state of subjection to the male sex. Voltaire's Jovian visitor * would be sure at once to observe with astonishment that the inhabitants of this planet were divided into two great castes, dependent on a physical condition which they could not control, and those who had the misfortune to be born females were doomed to perpetual tutelage or servitude to the higher caste of males. And the inferior position of woman, maintained through so many ages, has actually resulted in rendering her both physically and mentally inferior to man.

THE SUBJECTION OF WOMEN.

I have classed the inequalities between the sexes under the first great division of the social results of the reproductive forces, as being chiefly due to the operations of the love-passion—to feeling—and not to those of reproductive processes—to function. The first step toward the subjugation of the female sex was the conquest by the males of her prerogative of selection. This was the surrender of her *virtue* in the primary sense of the term—of her *power* over men, over society, over her own interests. But this crisis was brought on wholly by the force of male passion. It was a victory for male indulgence. Won by the aid of strategy and of superior mental power, it not only secured the result aimed at, but it led to the dominion of man over woman. It is one of the few instances where nature seems to have overshot its mark. The very excess of passion with which man (along with the males of all other species) is endowed, and which was apparently designed to prevent the possibility of the failure of reproduction, became, when coupled with this increased mind-force incident to a certain stage of intellectual development, the means of effecting the most extensive and systematic violations of natural laws, and of imposing serious barriers to reproduction itself. Nothing but its very gradual

* "Philosophie," vol. i. ("Œuvres complètes," tome xxxii), p. 15.

introduction and the slow habituation of woman to the change could have saved the whole race from extinction before the dawn of civilization. Again, the sexual passion in man was one cause of a more rapid intellectual development in him than in woman. Superior cunning, *i. e.*, sharper wits, may be regarded as a secondary sexual character as much as the tusks of the boar or the spurs of the cock.* Whatever was necessary to insure success in courtship was sure to be developed, and, when cunning became a safe weapon, it rapidly increased in the males until they outstripped the females in vigor of intellect.

It is undoubtedly true that the weaker physical condition of women during the period of gestation and parturition did much to give the advantage to the males. Although we do not perceive any special disposition on the part of other female animals at these times to make themselves dependent upon the males, we can readily understand how, with a higher development of the intellect, and especially of the sensibilities, they might learn to do so. In so far as this has been the case, the present dependent state of women upon men is to be referred to the second great class of results of the operations of the social forces.

But, to follow out the first line of development, we find that woman has already made her first great surrender, and permitted man to become the chooser in the matter of sexual unions instead of herself. He could not stop here. We have seen how the various systems of marriage grew up out of this fundamental fact. Woman at once becomes property, since any thing that affords its possessor gratification is property. Woman was capable of affording man the highest of gratifications, and therefore became property of the highest value. Marriage, under the prevailing form, became the symbol of transfer of ownership, in the same manner as the formal seizin of lands. The passage from sexual service to manual service on the part of women was perfectly

* Darwin, "Descent of Man," vol. i, p. 245.

natural. If woman was man's property for sexual purposes, he would certainly claim that she was so also for all other purposes, and thus we find that the women of most savage tribes perform the manual and servile labor of the camp.

In the earliest ages, when nations were devoted to continual warfare, the duties of men were defined, and, while the women were left behind to care for the children and perform the baser services, the men went forth to war, or took upon them the affairs of the state. This distribution of the labor of the sexes has always been preserved, as nearly as the state of society would permit. No moral or intellectual progress has been sufficient to shake it. The broad recognition of the social equality of the sexes has never been distinctly and practically made. All pretensions to it have been contradicted by the treatment of women, by their exclusion from the most honorable forms of labor, and by withholding from them social, civil, and political rights. To affirm that women are the recognized social equals of men is to betray the prevalent incapacity to see the plainest facts in a rational or abstract light, the inability to see them in any but a conventional light.

If women were the recognized social equals of men, we should see a very different state of society from that which now exists. We should, in the first place, see men and women wearing nearly or quite the same kind of dress. The slight modifications necessary to adapt the dress of each sex to its peculiar physical constitution would not be sufficient to make the difference noticeable, and would not, as now, make the form of dress a badge of sex. For it can not be urged that the present dress of woman is rendered necessary by reason of its adaptation to her physical constitution. The least acquaintance with the comparative physiology of the sexes, on the contrary, is sufficient to show that it is precisely the reverse—that, if either sex can afford to wear heavy skirts hanging from the hips and wrenching the loins, it is the male; that, if either sex needs the lower extremities and parts of the body thoroughly protected from exposure to currents of cold air, it is the female; that the practice of lacing the waist would be far less fatal to man than to woman, with her delicate uterine system so liable to displacement. And, even if nothing but the mere question of modesty were considered, it would be more proper for woman than for man to wear clothing to fit the body.

If the social equality of the sexes were recognized, we should see men and women performing substantially the same duties. In uncivilized races the drudgery and the honorable activities would be equally distributed between them. In civilized countries women would share all the varied occupations and professions with their husbands and brothers. There would be found very few avenues to wealth or happiness which women would be incapacitated to enter from purely physical reasons. There are, indeed, very few of them that women have not in some rare cases actually entered and successfully labored in. But, if their true equality were recognized, it would not be left for the few who dared to defy the rules of propriety to step forth into fields of usefulness to labor by the side of man. Not only would the duties, labors, and occupations of men be shared by women, but their pastimes, recreations, and pleasures as well. We should not see man amusing himself alone and in his own way, or in the society of men only, nor should we see women striving to become happy in the society of their own sex, and to derive pleasure from sources peculiarly their own, to which men are entire strangers. We should see a community of enjoyments, not differing materially, perhaps, from the present, but in which both sexes would join, adding to the animation which they otherwise afford the lively relish of sexual companionship. The present system, both of labor and of recreation, is calculated to bring out the worst side of sexuality. The separate duties and spheres in which the two sexes labor and move tend to render the desire for association a prurient one. The varied restraints of propriety and modesty have the effect of fanning human passions into a flame, and a consequence of this is that both sexes are liable to be whelmed in a vortex of crime, and their character and usefulness ruined. Equality in all respects would prove a certain antidote to all these social evils. It would do far more. It would transfer to the list of productive laborers the legion of women who now deem themselves wholly justified in occupying a position of dependency upon man, and consuming the fruits of his labor without adding the value of a loaf of bread to the wealth of the world. For this non-producing condition of civilized women is an anomaly in the animal world, and even among human races. Among the lower animals the labor of procuring subsistence is performed for the most part by each individual for itself, the males and females doing an equal share of the labor of life. This, also, seems to be substantially the case among the very lowest human beings; but, very early in the progress of the race, this becomes changed, so that most savages have a system in which the greater part of the industrial pursuits are carried on by the women, the men devoting themselves only to war and the chase; though of course both these, and particularly the latter, furnish the means of subsistence to some extent. This stage extends down into semi-civilized peoples and war-like races of all kinds. It is, however, succeeded by a stage in which every thing is reversed in these respects, and, theoretically at least, all industrial operations, war, and the chase devolve upon men alone, women being restricted to the reproductive function, and to that of being ornamental. In theory, this is the present system in civilized communities, but the manifest impossibility of carrying out the theory greatly heightens the evils of woman's condition.

The true progress of society must eventually complete the cycle of changes thus begun, and again make both sexes producers, as in the animal and pre-social stages.

If the equality of the sexes were recognized, we should see both sexes educated alike. We should see women admitted along with men, not merely to the common schools, but to all the higher institutions of learning, to the professions and to the technical departments. We should see the principle applied that it is mind which needs instruction, not male mind. Men and women would then stand on an equal intellectual footing, and intellectual superiority, without regard to which sex it appeared in, would receive its just recognition. Then, if woman fell below, it would be just to infer a natural deficiency. Had the same opportunities and the same restraints existed for both sexes from the beginning, it would then be possible to judge of their relative merits.

If the equality of the sexes had been frankly recognized, both would have been accorded the same rights. Not only would both sexes have labored together in the great duty, along with others, of framing, interpreting, and executing the laws of society,* but both would have enjoyed the same protection and advantages under those laws, and both would have been represented in all the branches of government by the same mode of representation, whatever that might be. Nor is it alone in political affairs that equal rights would have been extended. The social rights withheld from women are, if possible, worse than these. For under the head of rights may be ranged all the sexual inequalities named, and all that may be named. Education, industry, nay, even dress, are all of the nature of rights. To slight woman's education, to degrade and circumscribe her sphere of duty, to dress her with burdensome and unsanitary clothes—all these are deprivations of right of the most grievous nature. For every mind has a right to knowledge, every one has a right to choose his duties, and certainly

* Among the Wyandots and many other American tribes, women perform important functions in the council and government. (See Professor J. W. Powell's treatise on Wyandot government; "Abstract of Transactions of the Anthropological Society of Washington," 1881, p. 80; "Annual Report of the Bureau of Ethnology," 1880–'81, p. 61.)

all have the right so to clothe themselves as best to promote their comfort and successful activity.

But there are still higher rights, there is a still greater liberty which society withholds from one half its members. It is the right to themselves, the liberty of controlling their own persons, the possession of their own bodies. What a commentary upon professed civilization is the claim that the inactivity of the female sex is necessary to protect them from exposure to personal violence; that they can not pursue the free and honorable duties of men because thereby they would be exposed to insult! Or, if this be not feared, how shallow is the other plea that, if engaged in other duties than those to which society has restricted her, woman's modesty might be shocked by contact with the vulgar world! To so fine a point has this artificial sentiment been reduced! And this would be the place to show that it is this sentiment, more than any thing else, which has worked the degradation, the subjection, and the social enslavement of woman. To protect her from the rude advances of others, to preserve her in all purity for the use of her owner—these are the prime factors in the accomplishment of woman's present dependent condition.

I can not enter into a thorough discussion of the precise links which connect this whole train of social phenomena. I have outlined the genesis of modesty, and gone back to the origin of all the sexual inequalities. I leave it to the reader to fill in the web of circumstances and conditions which must have attended the slow evolution of these social conditions. I will only say, in concluding this theme, that the result of all these tendencies has been to separate and socially alienate the sexes; that, while the conditions of reproduction, not less than the power of the sexual appetite, naturally draw them toward each other, and must, under any and all circumstances, always keep them bound together indissolubly by bonds of sentiment, affection, passion, and interest, still the vast and ever-widening inequalities which have grown up between them tend to draw them asunder, and make their association and cohabitation more and more those of mere instinct and less and less those of genuine companionship. Incapable, on account of dress, of modesty, and of social custom, of sharing each other's labors or amusements, but compelled by such conditions to plod the path of life alone, each grows less and less necessary to the other, until all congeniality disappears, and marriage itself becomes a conventional formality. Incapable, in consequence of unequal education, of enjoying any intellectual communion, each seems tame to the other, and nothing is left of the conjugal relation but the mere animal gratifications. While the bodies of the two sexes will doubtless always continue to cling together, their souls are drifting apart, and the very elixir of human existence is being wasted upon the most unsubstantial frivolities and conventionalities. The great need of society is to be aroused to these facts, to be awakened to a new sense of the true and the genuine in life, and of the vanity and worthlessness of all forms and fashions not based on the severest rationality, and capable of withstanding the most critical analysis. The one thing which would confer a greater blessing than any other upon society, would be to open its eyes to the exact position which it has reached in its march, and to inspire it with a realizing sense of the wide departure it has made from the normal condition.

It is in the sexual department of social phenomena that the most glaring inconsistencies exist, and that the worst evils have been allowed to develop. It is to show this, and, as far as possible, to account for it, that I have entered into the consideration of the reproductive forces and their effects upon the human race. I realize both the importance and the delicacy of the subject, and hope I have not wholly failed in its elucidation.

The Male Sex not responsible.—In what has been said respecting the dependent and almost servile social condition of the female sex, I should be sorry to be misunderstood upon one point where I fear I may have left room for an unjust inference. Although I have been careful to avoid all allusion to the question of who is responsible for this condition of things, I am aware that the human mind is prone to infer that where matters are bad some one must be to blame, and to assume that, where a state of things is so organized as to discriminate against one class and in favor of another, the class which derives the benefit must somehow be responsible; and I have feared that for these reasons some of my readers might class me in the list of those who see in the male sex only a confederacy of usurpers and tyrants, who do nothing but seek for further means of humiliating and subjugating the female sex for their own gratification and emolument. If any have been inclined to accuse me of this species of *misandry*, they need simply to be reminded that I have been only seeking to study the condition of society, not to criticise the conduct of its members. If there is any responsibility in a sociological phenomenon, it must rest upon society as a whole. If there is one social fact which has received the sanction and approval of all classes of society, it is the existing relations of the sexes. If there is an evil in the world for which nobody is to blame, it is the inequality of the sexes. If there is an illustration of the victims of an injurious system countenancing and upholding that system, it exists in the case of women and the system which holds them down. The mere handful of enlightened protesters, who have become aroused within the past few years to a vague sense of their true condition, is but the very embryo of the movement which would be required to accomplish the emancipation of woman. And it is not so much experience as philosophy which is agitating the question. The victims of the system are usually silent, or, if they speak, it is but the bitter language of discontent unsupported by the philosophic analysis of the subject which can alone give weight to their utterances. The greatest champions of social reform are, and will always be, those who possess the capacity to grasp great social truths and an insight into human nature and the causes of social phenomena deep enough to kindle a genuine sympathy, and a sound, rational philanthropy. This phenomenon, like all others, is the result of causes operating through innumerable ages, and for which there is no more responsibility than there is for the physical transformations which species undergo from the operations of similar causes during still more immense periods. And, although the results may be bad and entail evil upon society, though they be irrational, absurd, and pernicious, they are none the less due to causes sufficient in their time to produce them, and their genesis, or true explanation, though perhaps too obscure for man ever to unfold, would still be traceable to their earliest origin if all the circumstances could be known. A state of society, if it be bad for one class, is bad for all. Woman is scarcely a greater sufferer from her condition than man is, and there is, therefore, nothing either improper or inexplicable in man's espousing the cause of woman's emancipation. The freedom of woman will be the ennoblement of man. The equality of the sexes will be the regeneration of humanity. Civilization demands this revolution. It stands in the greatest need of the help which the female sex alone can vouchsafe. Woman is half of mankind. Civilization and progress have hitherto been carried forward by the male half alone. Labor and production are now also suffering from the same cause. It is high time that all the forces of society were brought into action, and it is especially necessary that those vast complementary forces which woman alone can wield be given free rein, and the whole machinery of society be set into full and harmonious operation.

ATTITUDE OF SCIENCE TOWARD THE EQUALIZATION OF WOMAN'S CONDITION.

The general movement recently set on foot by the most advanced societies, for the elevation and amelioration of the condition of women, is obviously and confessedly crude. It is still in that stage, common to all progressive movements, in which only irresponsible persons will venture to espouse it, through fear of obloquy; one of the necessary results of which is that among its votaries there are numbered many fanatics on the one hand and charlatans on the other. It has as yet scarcely emerged from the stage of ridicule into that of sober argument. It is still almost completely under the influence of feeling, and is little subject to the control of reason.

In this condition it greatly needs aid from science, and it should be the aim of scientific men, particularly of those who regard the phenomena of society as legitimate scientific data, to furnish so truly progressive a movement with a basis of facts and fundamental principles, thus lending it a tone of serious import and respectability, while at the same time turning it from its manifest errors and directing it into rational and practical channels.

The few true philosophers who have sought to accomplish this object, however, have been disappointed to find that scientific men in general do not rise to their stand-point, while many true advocates of social progress in other things do not think that the relations of the sexes can be rendered more perfect than they are.

It is especially unfortunate to find that the present *status* in this respect is actually defended by arguments from sciences more simple than sociology. Certain facts in biology are cited, and these are assumed to prove that the existing condition of things is a *natural* one, and in all respects analogous to that which exists in the animal world below man.

It is argued that in most mammals the female is in many respects inferior to the male, and performs different functions; that in birds and many other lower creatures the males are more beautiful, larger, more sagacious, and are exempt from the more unpleasant labors incident to the rearing and protection of the offspring. It is claimed that facts of this kind serve to point out the *purposes of Nature*, and it is assumed that whatever can be shown to be *natural* must be the best possible condition.

Arguments of this kind, coming from high scientific sources, have great weight, especially as those to whom they are chiefly addressed are incompetent, as a rule, to judge of the adequacy of the premises, and accept them as resting upon authority.*

If it were worth while, it would be easy to deduce from natural history a large number of facts of precisely the opposite class, from which it might with equal force be argued that the purpose of Nature was to favor the females and slight the males. Indeed, it is a fundamental biological truth that, so far as the mere "purposes of Nature" are concerned, the fertile sex is of by far the greater importance, and this increased importance is abundantly shown throughout all the lower forms of life where these purposes are predominant. Thus in plants, the hemp is by no means a solitary example of the great partiality shown to the female plant, and in which the male plant is comparatively a puny and ephemeral thing, only attaining a small size, leading a precarious existence, and early withering and dying before the encroachments of the large and thrifty female plants, which literally crowd it out of existence as soon as it has performed its function of fertilizing the latter. The same disparity is observed in *Thalictrum dioicum*, *Antennaria plantaginifolia*, and to a greater or less extent in all strictly diœcious plants.†

In the animal world there are many equally forcible examples of Nature's favoritism of the female sex. In the

* See an article in the "Quarterly Journal of Science," for October, 1878, on "The Woman's Rights Question considered from a Biological Point of View"; also, W. K. Brooks, on "The Condition of Women from a Zoölogical Point of View," in "Popular Science Monthly," vol. xv, pp. 145, 347 (June and July, 1879).

† Professor Thomas Meehan, in treating of certain plants, is led to remark that the female sex seems to denote "a higher effort of vital power" ("Native Flowers and Ferns of the United States," vol. i, p. 47).

lower orders, the rule, above referred to as applicable to most mammals and birds, seems to be exactly reversed. Here the females are usually larger and stronger and often more beautiful than the males.* Every entomologist knows how far this is the case with insects. A queen-bee is in every way superior to a drone, while the working-bees are all sterile females. In spiders this differentiation is carried to the greatest extremes,† the female being usually much larger, often very many times as large, and more beautifully marked. In at least one species, the function of the male is so entirely confined to the one duty of impregnating the female, that it seems to be the regular practice of the latter to seize and devour her miniature consort as soon as this duty has been performed! There are, moreover, instances in which, as in *Sphærularia Bombi*, the female is several thousand times as large as the male; and, without going down to the *Rotifera*, there are numerous insects (bees, ephemeræ, etc.) in which the male function is confined exclusively to the "*Minnedienst.*"

But cases are by no means wanting among vertebrates in which the female enjoys a decided ascendency both in structure and function over the male. This occurs among fishes (*Gasterosteus*, *Silurus*), amphibians, and birds. In the case of the American ostrich (*Struthio rhea*), the male, although the larger, sits on the eggs and hatches them, and takes the principal charge of the young. The same is true of the emu, and is probably common to most allied species. In most birds of the hawk family, the female is larger if not more highly plumaged than the male. Of the male and female marsh harriers (*Circus cyaneus*, var. *Hudsonius*) in my collection, the latter exceeds the former in length by more than an inch.

There are many birds in which the two sexes are in all respects equal, while such cases are by no means rare among

* Darwin's "Descent of Man," vol. i, pp. 335, 336.

† *Loc. cit.*, pp. 327 *et seq.*

mammals. Differences here, when they exist, are due to sexual selection, which the writers referred to perfectly understand, and, so far from this indicating the purposes of Nature, it is simply the result of an excess of individuality and personality among the eager males, which, in their strife to secure the gratification of their physical desires, have to this extent thwarted Nature's purposes, and brought about these comparatively anomalous differentiations.

But it must also be denied that the condition of the sexes among those animals in which the male is superior is at all analogous to that of men and women whether in their savage or civilized state. Just as the sexual differences in the former are derivative and anomalous, and due to the rise of the cerebral power, so those of the latter are as much more unnatural as that power is more pronounced in man than in animals. Especially is this true with regard to the respective duties of the sexes. In no animal do we find any such differences of function between the sexes as is presented by men, either savage or civilized. The males and females of all animals equally pursue the natural impulses which prompt them to activity, and in no case is it left for the females to perform all the labor necessary to maintain the physical life of both sexes, as is often the case with savages; nor does it ever occur that the female devotes her whole time to the rearing of offspring, while the male procures the subsistence for himself and her and brings her portion to her, which is the theory of the most civilized societies.

While, therefore, there is really no parallel and no analogy—and while, if there were, it would not indicate in the least what the purposes of Nature are in this respect (even if Nature had any purposes), but rather, so far as the paramount object of reproduction is concerned, would prove that, in proportion as female superiority is diminished, this object is defeated—I have nevertheless thought best, before considering the assumptions of this specious argument, so called, from science, to show that the facts themselves are wholly at fault.

Independently, however, of its false facts and false premises, this pretended scientific defense of the undue inequality of the sexes in man is fundamentally unsound in resting upon a thoroughly false assumption, which is only the more pernicious because widely prevalent. It assumes that whatever exists in nature must be the best possible state.

This sort of *scientific optimism* is, if possible, worse than theological optimism (vol. ii, p. 45). There may be a certain sense in which "whatever is is right," but there is no ground whatever for asserting that whatever is natural is best (*supra*, p. 71). All true social progress is *artificial*, and this is just as true of laws and institutions as it is of machinery. All social as well as material progress must aim to alter and improve the old status, or it is no progress at all. Those nations which always point to their ancestors as types of all that is perfect are proverbially stagnant and effete. But what shall we say of scientific men—men who believe in a humble animal origin for the human race—when they point back to that animal world from which they sprang, for examples by which to justify some of the worst features of our still imperfect social relations!

The truth is, that, if they *could* find a parallel in biology or any other science for such a state of inequality, this would be no bar whatever to the attempt to ameliorate that state. The only practical use to which we put science is to *improve upon nature*, to control all classes of forces, social forces included, to the end of bettering the conditions under which we inhabit the earth. This is true civilization, and all of it. It is rather a disgrace to civilization—which has thus redeemed almost every thing else from the rude, wasteful, and heartless dominion of Nature—that it has left the relations of the sexes untouched, or has even aggravated in the human race those existing in the brute. But it is positively shameful, in such a state of things, for scientific men, Bourbon-like, to go back to the brute creation for standards of human excellence and models of social institutions.

We should congratulate ourselves that we are neither lions nor spiders nor yet cave-dwellers, but civilized men, and should seek so to shape the social policy that honor, justice, and equity should prevail, rather than the instincts of brutes or the caprices of savages.

SEXUO-SOCIAL DYNAMICS.

In considering the sociological effects of the reproductive forces, I have confined myself to the direct or immediate results of the action of the sexual passion. The natural *consequence* of these forces is reproduction itself. While this effect is, doubtless, the prime consideration from the statical point of view, and possesses a vast importance to the student of society and of man, it nevertheless does not belong to the discussion in which we are now engaged; and this for obvious reasons. The social forces, in the sense in which they have been here spoken of, are those influences which impel man to action. They are qualities residing in men which determine and control their physical activities. They have their seat in the nervous system, and are what inclines the body and limbs to move in any particular manner. We call them *desires.* They are the monitors which prompt us as to the demands of the system, and propel us toward the object demanded. Now it is human activity which has exerted the great influence upon society that has resulted in making it what it is. It is *action* (vol. ii, p. 376) which has worked out human civilization. All this activity has been put forth in the effort to secure the objects of desire. It is not the mere securing and appropriating of these objects that are attended with all these vast and far-reaching consequences. It is the acts committed in the effort to secure and appropriate them. True, the securing and appropriating of the objects of desire are necessary to the existence and perpetuity of society and of the race, and are, in this respect, of first importance; but they represent no change, no progress, no improvement in society. They are simply the co-efficients of the social forces. They represent persistence, continuance, quantitative increase. The activities, on the contrary, consequent upon the desires, are ever modifying the very character of society. They act upon the quality of the social condition—change, elevate, refine, and advance it. Nay, as we have so often seen, they frequently complicate and distort it into a far worse condition than that in which they found it. It is these desires, therefore, and the activities which they create, that should form the theme of an inquiry into the conditions of human progress and social metamorphosis. The indirect or consequential results of this successful activity belong to another field of investigation.

B. THE NON-ESSENTIAL SOCIAL FORCES.

Thus far we have been considering those great social forces which, through the gratification of the desires and passions that constitute them, are essential to the existence and continuance of the race. These two objects—the preservation of the life already in being, as long as the form of organization is capable of sustaining it, and the reproduction of other similar organisms through those already existing—are what I have denominated the *objects of nature*. If we can conceive of an intelligence as manifesting itself in the operations of nature, the most obvious mode of this manifestation is certainly the apparent solicitude displayed in securing these two objects. And even to those who are capable of comprehending the genetic explanation of all the phenomena presented by nature, or of conceiving how such an explanation might be made if the means of discovery were within the reach of man's limited field of investigation, the phrase *objects of nature* must convey a notion sufficiently distinct to enable them to contrast these natural operations with others, in connection with which there are no consequences beyond those which follow immediately from the acts performed. The essential part of those acts, which are impelled by the two great forces just considered, does not consist in the direct or regular effects of those actions, but in other indirect and ulterior effects which have no apparent connection with the acts themselves, and which form, especially in animals, no part of the incentive to their performance. If these effects help to strengthen the incentive in man, it is because his reason has enabled him to learn by experience that such effects will follow such causes. He would never discover this by any course of reasoning *a priori*, but, by reasoning from the *data* of long unvaried experience, he now knows as positively as he knows any physical fact that it is eating which preserves life, and sexual union that perpetuates it. But I venture to say that there is not an animal below man that ever excogitated this truth. They do not do these things for the sake of preserving life or their species. They do them in obedience to internal physical desires, to inherent physiological forces. And man is not far in advance of them, for, though he may know the essential effects of his acts, this knowledge forms but the minutest fraction of the motive which really prompts their commission. He, too, acts from impulse, from inherent promptings, from physical desires. He, too, obeys the same physiological forces which, under the guidance of reason, have had for some of their direct effects the important and astonishing social modifications which have been cursorily and imperfectly sketched in the present chapter.

But, as was stated in the beginning of the inquiry, in addition to these great essential forces, there are others which may for the same reason be called non-essential, since they are not indispensable to the life of either the individual or the species, which, nevertheless, are attended with direct results, scarcely, if at all, less wonderful or less important than those which have flowed from the essential forces themselves.

The Physical Aspect.—The forces of society are all ultimately reducible to a physical basis. They have their origin in the human body, and, no matter how much they may become etherealized and spiritualized by psychological and intellectual influences, they may always be traced back to the body, the source of them all, even of the mind itself. Moreover, every one of them has a more or less definite local seat. No task is easier than to localize the two most important of all human desires, those which make up the preservative and reproductive forces. The preservation of life and the vast train of industrial and economic consequences which flow from the operation of the preservative forces of society all have their seat and local origin in the tongue, the palate, and the stomach, all center and focalize in the sense of taste. The seat of the reproductive forces is still more definite.

The non-essential forces, though not all of them so definitely localized, have still their appropriate physical origin. The two senses sight and hearing form each the basis of an important class of social forces. The emotions, embracing all that class of feelings which modern languages metaphorically call the "heart," though they can not claim that organ as their home, nevertheless reside in some part or other of the nervous system, and have as purely physical an origin as any of the rest. And, finally, the intellectual forces, which guide and control all the others, and thereby impart to them their progressive character, are snugly locked away within the cavity of the cranium.

These constitute the non-essential forces. Whatever motive power has been exerted in society which can not be referred to the groups already considered can find a place in this one.

The non-essential forces are divided into three classes, those of the *senses* of sight and hearing, those of the *emotions*, and those of the *intellect*. Those of the first class underlie and procure all the advance which society makes in the fine arts, and may be called the *æsthetic* forces or faculties. Those of the second class control and determine the changes which society undergoes in its customs, sentiments, and desires. They may be called the *moral* forces. Those of the third class regulate the thought, judgment, and intelligence of society, and need no better name than the *intellectual* forces.

Some of these are derivative, and have grown out of the two primary social forces, and much that might be considered here has already been brought under those general heads.

Undue Prominence popularly given to the Non-essential Forces.—It may be remarked that, while these non-essential forces are really of far less importance than the essential ones in the history of social progress, yet it is these which have most attracted the attention of mankind and received the first place in all systems of social philosophy.

It is under this head that are to be classed all those social phenomena which have appealed to man's perceptions and forced themselves upon his observation. The obtrusive but superficial events of human history, as well as the more irregular, eccentric, or violent acts of private life, are the results of the action in some direction of some of these non-essential forces, and, while they bring themselves forcibly to the notice of all within the reach of their influence or observation, their aggregate effect is small as compared with that which is produced by the quiet but powerful and incessant operation of the original forces of nature. The former are superficial, irregular, capricious, and sporadic, the latter deep-seated, regular, reliable, and perpetual. The first are merely the product of the latter, the necessary outbursts of their intense and protracted activity. Just as the vast internal heat of the sun makes its surface seethe with fiery billows, so the deep social activities throw perpetually to the surface billows of passion and fierce storms of emotion. But the real weight of the latter bears no greater proportion to that of the former than the solar flames of incandescent hydrogen bear to the substance of the sun below them.

It will be borne in mind that the social forces of which we are speaking are, and must necessarily all be, of the nature of desires. Whichever one of them we are discussing, therefore, we must regard constantly from this point of view. We must come back, in each case, to the fundamental conception of pleasure and pain, of agreeable and disagreeable sensation. It is always the inclination to secure pleasure or escape pain that prompts action, and it is action which effects the change in the character or constitution of society.

1. The Æsthetic Forces.

If now we consider the *æsthetic forces*, we find that certain forms of manifestation to the eye and ear produce upon those organs pleasurable effects. The growth and development of the fine arts has consisted in nothing else than the systematic intensification of these pleasures. Like all other forms of progress, this was accomplished simultaneously in two ways—a subjective and an objective; by increasing the *capacity* for enjoyment on the one hand, and the *means* of enjoyment on the other. And, in all this, the development of the intellect has performed the same curbing and directing part, as in the case of all other social forces.

The love of the beautiful, both in sight and sound, has always existed in man, and doubtless exists in some form in all animals. It bears a certain ratio to the degree of general development and refinement of organization. In man we find it cropping out in various ways, from the earliest periods to which any account of him can be traced. No stage of civilization has ever been discovered which has not left evidences of progress in the fine arts. Some of these are enduring and still exist to mark the era of their construction; some have come down only through tradition; so that, while we have an Apollo Belvedere, a Laocoön, and a Dying Gladiator, we have only mythical traditions of the great musicians Apollo and Orpheus.* Enough, however, is known to show that, as fast as the condition of the race rose to a point where any portion of its energies could be spared from the labor of sustaining life, they were always directed into æsthetic channels. There was always a latent æsthetic force, ready to manifest itself whenever the demands of the preservative forces were fairly satisfied.

FINE ARTS THAT APPEAL TO THE EYE.

There are four great departments of fine art appealing to the eye, viz., sculpture, painting, landscape-gardening, and architecture. The first three of the arts which please the eye are attempts to imitate nature. Sculpture gives form; painting, color, and a representation of form; while landscape-gardening is nature itself, adorned to please the particular taste of the artist. Architecture is the connecting link between the fine and the practical arts. It does not seek to imitate nature, since a building is a direct improvement upon nature for man's comfort, convenience, or admiration. It is therefore an expression of a desire to combine with this comfort and convenience a degree of symmetry and beauty sufficient to gratify the eye, at the same time that it ministers to the other demands of the body. It is therefore an art in the *highest* degree, just as landscape-gardening is an art in the *lowest* degree. The latter is the nearest approach to nature itself, the former the farthest remove from it. The one pleases by its regularity, the other by its ir-

* Although the mathematical laws of accord were discovered by Pythagoras, or perhaps by the Brahmans of India, from whom he may have taken them, and were known to Aristotle, it is not probable that any progress was made by the ancients in the art of producing harmony. Their music, whatever it was, must have been chiefly confined to melody, and this remained true down to the time when the gamut was invented by Guido Aretino, in the eleventh century, and a system of musical notation was adopted. Musical notation has had an effect upon the art quite analogous to that which the art of writing words has had upon language and ideas. (See Carpenter's "Mental Physiology," p. 235; Samson's "Art Criticism," chap. iii.)

regularity. Architecture delights in straight lines, regular curves, and other symmetrical figures; landscape-gardening, in crooked and uneven lines and amorphous objects.

It may be said that natural objects present perfect and symmetrical forms such as please the eye in architecture, as in crystals, flowers, etc. This is true, but it is confined to those natural phenomena which are produced by the action of *molecular* forces, and is usually on too minute a scale to be recognized by the eye of the casual observer. The natural objects which call forth the truest æsthetic sentiments of men are large aggregations and combinations of regular molecules, so unequally thrown together that all traces of their molecular symmetry is lost sight of. They are the products of the *molar* forces, which may be called the forces of variety and irregularity, while the molecular forces are those of unity and regularity. The boundless variety presented by these amorphous objects lends them a charm which calls forth the liveliest æsthetic emotions. And yet the eye loves symmetry, and delights in perfect lines, angles, circles, and other curves, and this preference finds expression with all true artists in the artificial grouping of objects in pictures, so as to place each group in the center of an imaginary circle. The same tendency displays itself in landscape-gardening, and is usually carried so far beyond nature in the laying out of circles, curves, and rows, that it ceases to be an imitation of nature and becomes an ideal creation. There are very few objects large enough to appeal to the æsthetic faculties which are not so far removed from the play of the molecular forces as to leave no traces of the regularity of their workings. The flower comes as near to this unity as any object in nature, unless it be the outline of the nearest celestial bodies. A close observation of the vegetable and animal kingdoms reveals great regularity and persistency of typical forms in the same species, but very few of these forms can be called geometrically perfect. And, while all will unite in pronouncing the greater part of them graceful and beautiful, any one can readily distinguish this species of beauty and regularity from that which results from exact geometrical measurement. A tree is an object of beauty, and may be pronounced perfect, and yet there may not be a single perfect line in its entire configuration. The serpentine stream, that winds in exquisite loveliness through the meadow, does not present a perfect curve in any part of its extent or a similar curve at any two points. The molar objects of nature are the very embodiment of irregularity and chaos, but combine with this sentiment a certain soul of unity concealed within them. The forms of mountain-ranges, the shape of continents and islands, the indentations of shores, the windings of rivers, the location of trees in forests, the undulations of the earth's surface, and the fantastic shapes of clouds—all these are but so many emblems of disorder and confusion; and yet, as the mind contemplates them, it gets a glimpse of the reign of law which it feels must exist within them, and of the wider cosmical rule which presides over them all, and the blending and co-existence of these sentiments produce a pleasure of the purest and most exalted kind. This sentiment bursts out on every occasion in the lofty ambition to imitate the objects which have called it forth. Nay, it rises higher, and aspires to combine in some grand synthetic scheme all the beautiful and sublime ideas which have been inspired by many objects. This is *imagination*, improperly called creative, since nothing can be woven into the piece which has not, either in detail or in gross, been impressed upon the sense-perception.

The passion which the mind possesses for geometrical figures teaches us unmistakably that even nature would be more charming if more of its exact constitution could be constantly revealed. It is this yearning to obtain a deeper insight into the internal structure and constitution of these aggregated masses which forms one of the chief incentives to scientific study. So near do art and science approach each other! So narrow is the line which separates the æsthetic from the intellectual emotions! And it is the province of science, of minute observation and repeated experiment, aided by the wonderful artificial appliances which have been and remain to be invented for supplementing the eye, to build up a new school of art which shall be inspired by both classes of natural objects, and shall combine in their productions the vague and dreamy beauty and sublimity of molar aggregates with the exact and definite perfection of molecular forms.* It is the province of science to open up to the world of sentiment and imagination all the beauty, symmetry, and order that reign in the microcosm of molecular activity. Such a school, though somewhat restrained in its flights of imagination, would afford the lovers of the true and the beautiful not only representations unequaled by any of the productions of the old, in all that commend them to the æsthetic faculties, but along with them lessons of valuable instruction in the very primary methods by which Nature embellishes the universe.

FINE ARTS THAT APPEAL TO THE EAR.

The pleasures of sound, when properly estimated, form no small part of the history of the æsthetic faculty. The laws of harmony have been much longer and better understood than those of vision. The way to render sounds pleasing and the reason why they are so have long been reduced to a degree of certainty which has not yet been reached in the domain of optics. This is because the medium of sound has been recognized from very early times, while that of light is as yet imperfectly understood.

* Historically, the faculty which delights in regular forms and objects preceded that which delights in irregular forms and objects. This is proved by the passion of savages for beads, trinkets, etc., as well as by their indifference to the beauty of the landscape, and to most of those objects which cultured races call grand or sublime. The failure of mankind to discover any of the natural beauties, now so classical in Europe, until since the sixteenth or seventeenth century, shows that this is as true of the Indo-Germanic race as of other barbarians. (See Humboldt's "Kosmos," Bd. ii, S. 16, 23; Burnet, "The Sacred Theory of the Earth," vol. i, pp. 194–196; Carpenter, "Mental Physiology," p. 514, etc.)

One of the most interesting questions connected with the history of music is the variety which is found to exist in the capacity of different races of men for recognizing, enjoying, and producing harmonious sounds. Why is it that the aborigines of America are almost destitute of this faculty, while those of Africa possess it in an exceedingly high degree?* All nations and races are, doubtless, susceptible of deriving a certain amount of pleasure from sounds, and the power of recognizing harmony bears some proportion to the general degree of development. Yet there are found the widest differences in this respect, not only between equally enlightened peoples, but between inividuals of the same race and nationality. There can be no doubt, however, that culture is capable of producing the greatest changes, and there is probably no people who could not in the course of many generations be made, by the proper culture, a musical people. I do not think the Caucasian race the one most highly favored by nature in this respect; and yet see the wonderful talent for music which it has shown, culminating in Mozart and Beethoven!

At first glance, it would appear that the department of art which appeals to the eye is that which must have made itself most powerfully felt upon human society. The vast range of its objects, the varied modes of its expression, and the boundless scope afforded by it to the imagination, would seem to place it far above the limited domain and influence of the department which appeals only to the ear. But, when we remember that the cultivation of music has been rendered far more popular, and the acquirement of the art has been placed within the reach of the masses by the invention of popular musical instruments, while both painting and sculpture are still monopolized by the highest genius, and their choicest productions appropriated by the few who combine

* See a paper by Herbert Spencer on "The Comparative Psychology of Man," read before the London Anthropological Institute, June 22, 1875.—("Journal," vol. v, p. 312.)

wealth with taste, we can not longer doubt that the influence of music in the aggregate is greater, at least in modern times, than is that of all the remaining fine arts combined.

The ancillary arts of engraving and lithographing, and especially that of chromo-lithography, are, it is true, coming in to supply one of the greatest demands of man's higher nature, and may eventually result in raising the real sociological influence of representative art to its proper degree. There is little hope of sculpture ever becoming a popular art, while landscape-gardening on any popular scale is as yet, and must for a long time remain, quite incompatible with the social economics of the world. But music, engraving, lithography, and photography will continue to exert more and more their refining and elevating influence, in heightening and perfecting the æsthetic faculties of mankind.

The love of the beautiful, both in sight and sound, has ever been and ever must be a reliable social force, ready to manifest its power on every occasion, whenever the great vital demands of existence cease to absorb the energies of society. In proportion as man's physical wants are supplied, and his social and sexual relations placed upon a natural and satisfactory footing, the practical arts, the industrial character, and the cold business features of human life will be relieved, subdued, and embellished by the softening and cheering presence of works of art, and by the perpetual charm of music and poetry. The total effect of the operation of the æsthetic forces has not been inconsiderable, and could not consistently be omitted from a consideration of the conditions of social progress.

II. The Moral Forces.

Under the head of moral social forces are to be classed all the emotions which are metaphorically and not altogether inappropriately said to reside in the human breast, except in so far as the sexual emotion, in its fullest scope, may be said to do so.

The moral forces, or human emotions, are susceptible of various kinds of classification. I shall, for my present purpose, divide them into two classes, which, while they may not embrace all possible forms of sentiment, possess the advantage of being quite distinct and not overlapping each other so as to confuse the mind in their consideration. These may be respectively called the *love-forces* and the *fear-forces*, *i. e.*, the sentiments and emotions which have love (other than sexual) and its opposite, hate, for their basis, and those which have fear and its opposite, hope, for their basis.

The primary foundation of all emotions is, of course, sensation, or feeling. Sensations are frequently called *sentiments*, a word of kindred etymology, and very commonly *feelings*, which they unquestionably are.

With sensation there is connected either a pleasure or a pain. The pleasure which love affords is due to a certain harmony between the constitutions of the one loving and the one loved. *Vice versa*, a want of harmony, or *discord*, in two natures produces dislike, or hate. This harmony or inharmony of constitution, however, stands in no fixed relation to the character of the constitutions themselves, or, at least, is not due to any similarity or dissimilarity between them, for nothing is more common than to find the warmest attachments between diametrically opposite dispositions. It is not resemblance or similitude, but a certain congruity or congeniality, which begets that intensity of interest in others, amounting to affection and love. The incongruity of temper which engenders dislike, or hate, is an equally subtile and unintelligible quality.

The second class of emotions having fear as their basis is as clearly traceable to the same common origin as is the one just considered. The true basis of fear and hope is always, in its last analysis, pain and pleasure. It differs from the love-sentiments in this respect only in time. Fear and hope, from their very nature, have reference to the future. The pain feared and the pleasure hoped for are things to come. And yet in this very anticipation there is a real pain and a real pleasure, sometimes even more intense than the actual participation (vol. ii, pp. 150, 284).

The love and hate sentiments are direct and immediate, while the fear and hope sentiments are indirect and remote, as regards their object. The former have for their objects others than those who experience them. The latter have self alone for their object. The case of self-love may be deemed an exception to this, but it is only an apparent one, since, even where self is the object of love, it is as an external object that it is regarded. In other words, the love-sentiment is always objective, while the fear-sentiment is always subjective.

Let us now very briefly consider the emotions from these two points of view.

THE LOVE-FORCES.

If we were to begin with the most direct and physically objective of all human sentiments, we should first glance at the sexual passion itself, or the mutual attraction which nature establishes between the sexes in the interest of reproduction and the perpetuation of the race. But, inasmuch as this subject has already been treated at length, we are enabled to pass on to other and less important emotions.

Parental Love.—The feeling most nearly related to the sexual, and which doubtless has some obscure connection with it, is that of philoprogenitiveness; this is especially distinct and apparent in the female sex, where it comes very near being an essential force, since in man and most animals the life of the new being is dependent upon its existence. This sentiment may, by attending to that part, be clearly perceived to reside in the breast. It would be wholly unnecessary to dwell upon the importance and extensive influence of the sentiment of parental love upon society. Next to the sexual sentiment, it is the great bond of the family, and the family is the most important social institution of mankind.

Consanguineal Love.—After the love of offspring there comes consanguineal love—the love of one's own kindred. Every one is supposed to entertain a feeling for his own relatives quite different from that which he feels toward the rest of mankind. This sentiment is artificial, as is proved by the fact that the lower animals do not appear to share it with man. It is distinct from philanthropy, and is something more than the result of mere association. Almost any one will uphold and defend a relative where he would not at all excuse one who was not related, and this sentiment is stronger in the lower grades of society. With a high degree of enlightenment, reason places all men in more nearly the same light, and we learn that our relatives are as imperfect and fallible as the rest of mankind.

The great strength of kindred ties, especially among the less civilized races, must be accounted for as the result of those influences which lie at the basis of the social system itself. Society could not exist until the form of marriage became sufficiently stable to determine relationship, at least with one of the parents. The primitive idea of the family, though variable, was not the modern conception, as the immediate children of two parents, but as the kindred of a stock; and accordingly we find, among most of the uncivilized tribes of the world, a sort of communal life to exist, based on kinship, and expanding into larger organizations called clans or gentes, phratries, tribes, and nations.

Patriotism.—From the circle of the family and the consanguineal nucleus the affection gradually expands with advancing civilization. *Patriotism* is the next sentiment, but it begins very humbly. At first it only embraces the clan or tribe, then extends its limits to take in the state. But, as the state itself increases, the patriotic impulse keeps pace, or should keep pace, so as always to be commensurate with one's country. Whenever it does not do this, there is danger that the country may fall. One of the best tests of a nation's fitness for territorial expansion and of its perpetuity may be found in the comprehensiveness of the popular sentiment of patriotism. As soon as this is found to come short of embracing the whole country—as soon as the smaller sections or political divisions become paramount to the whole country—it is evidence that it is becoming too extensive for its people, and a check should be at once put upon its growth. It was this disproportion, or overgrowth, which came so near whelming this country in ruin in 1861, and it would undoubtedly have succeeded had the same degree of sectionalism prevailed in the Northern as in the Southern portion of the Union. When I heard Georgian soldiers speak of their State as of a great independent country, the whole philosophy of the "rebellion" was laid bare. If the day ever comes when the whole world shall be embraced under one grand politico-social commonwealth, the only condition which can keep it there will be the existence every-where of a prevailing sentiment of cosmopolitan patriotism. This sentiment will be akin to humanitarianism.

Philanthropy.—The next step after patriotism is philanthropy, the sentiment which goes out for all mankind, and desires the happiness of the most remote in kindred or nation, as well as that of immediate relations and countrymen.

These are the positive impulses which control the moral world. Their influence upon society is immense in preserving the most important of human institutions. Parental love is what shields and protects helpless infancy and imprudent youth. Filial and fraternal love is what cements the family and the consanguineal circle. Patriotism is essential to the life of the state, and thereby secures the protection of all those economic and industrial institutions which are fostered by the state. Philanthropy exerts a benign and pacific influence upon all mankind, although it has as yet only begun to extend beyond the very select few who possess an insight into social phenomena.

Self-Love.—Last of all, and perhaps greatest among this class of sentiments, comes the love of self. In its worst manifestations, where it is in excess, it takes the forms of egotism, pride, and conceit, and crops out every-where in imperfect human nature, forming one of the chief evils of social existence. It is probably a product of selection, since there is no doubt that an inadequate supply of self-love would be fatal to success in maintaining a subsistence, but we could wish that, in this, nature might have been more exact, and not lavished a commodity upon society, any excess of which beyond the necessary amount is so detrimental to its happiness. When evenly balanced, self-love takes the form and name of self-esteem, a very salutary sentiment, as we readily perceive as soon as any one is found deficient in it. When self-love looks to the future, it takes the form of ambition, or, perhaps more correctly, it produces that sentiment. Ambition, whether to do or to be any thing, is always prompted and nourished by self-love. For the most universal concomitant of self-love or self-esteem is the desire to be loved and esteemed by others. And the one who is ambitious to accomplish some cherished object, not less than he who is ambitious to attain a certain standard of personal excellence, is aiming, as his chief end, at securing for himself a greater amount of esteem and regard from his fellows.

Ambition, considered in reference to all its many objects, is one of the most important of the non-essential or superficial forces, and has wrought great changes in the condition of society.

CORRELATIVES OF THE LOVE-FORCES.

But love, in all its forms, has its correlative. For every love there is a hate. If there is an exception to this rule, it is in the case of philanthropy, and even here few have failed to observe that those whose hearts glow most warmly for their fellows are usually most severe and embittered against the authors of misery and suffering in society.*

The correlative of sexual love is as much more fierce and terrible than other hates as that passion is more intense and sublime than other loves. I need not dwell upon the influence of jealousy, the origin of which has already been touched upon (*supra*, pp. 622, 623).

The correlative of parental, and particularly of maternal, love is a powerful and almost irresistible passion. When once the fruit of her own body is put in jeopardy, there is no hardship too great for a mother to undergo, no act too bold for her to undertake. It has fallen to the lot of poetry and the drama to illustrate, in innumerable ways, the power and grandeur of this sentiment. Indeed, but for it, the helplessness of infantile humanity would jeopardize the existence of the race.

Passing over those family feuds and miniature battles which are the frequent and inevitable correlates of consanguineal affection, let us just notice the extensive nature of the reactions which patriotism engenders. It may almost be said that love of country is the true cause of all the warfare that is waged among nations. Out of it grow pride, arrogance, an excessive sensitiveness to disrespect, and an overweening confidence in the military power of one's country, all of which combine in a thousand ways to plunge nations into difficulties and sanguinary wars.

THE FEAR-FORCES.

From this hasty enumeration of the emotions, having love and its opposite, hate, for their basis, we will pass to the other class, having for their basis fear and its opposite, hope. The nature of the physical body as a reservoir of emotions gives rise to innumerable acts having for their ob-

* It has been frequently remarked that great philanthropists are often tyrants in their own families. This has been said, how truly I know not, of the great John Howard, and in my own experience I have seen the principle verified in one quite remarkable instance.

ject the regulation of the quality of these emotions. As desire, from which all activity flows, is simply a name for the tendency of sentient matter to escape unpleasant and seek pleasant sensation, so the activities of sentient beings are perpetually directed to averting pain and attracting pleasure. From this point of view it would be correct to say that every act is prompted by fear or hope. But this sense is too technical for our present purpose, and we shall place the popular interpretation upon all the natural acts of life—that they are prompted by a sort of instinct or inherent impulse, in which the relation between the subject and the object is too close in point of time to require the degree of forecast, and call out the notion of future effect, which are involved in the idea conveyed by the terms fear and hope. That there is, however, no clear line of demarkation, may be seen when we apply the principle to the animals below man. We thus perceive that the terms fear and hope are not exactly equal in their scope. We frequently ascribe the acts of even the lowest animals to the effect of fear, but rarely to that of hope, the latter term being more restricted in its meaning. And yet animals are not wholly destitute of the sentiment of hope. The horse, when he quickens his pace as soon as his head is turned homeward, is as much inspired by hope as he is by fear when he does the same thing at sight of the uplifted lash. The difference in the force of the two terms is one of degree. Either may be strained to embrace all forms of action; but, when left to their normal sense, fear is more comprehensive than hope, and does not require the same distance of time between the act and the sentiment. It is for this reason that I have placed it first, as though it were the positive term, though it would naturally appear to be the negative term. And it is this same quality of superior comprehensiveness which has caused fear to play a so much greater *rôle* in the history of human society than hope has done, and which has justified me in denominating this class of forces the fear-forces.

CLASSIFICATION OF THE FEAR-FORCES.

The fears and hopes of mankind are capable of as many modes of classification as are the varied human susceptibilities to suffering and enjoyment. They may be divided into physical and mental, into temporal and spiritual, into approximate and remote, into real and imaginary, into secular and religious, and into many other equally distinct divisions, for the purpose of minute analysis. I shall endeavor to present a general view of them under the two heads of *physical*, or such as anticipate pain or pleasure to the body, and *psychical*, or such as anticipate pain or pleasure to the mind, or soul. The former are always temporal and secular, but may be either approximate or remote, real or imaginary. The latter are spiritual, and form the warp and woof of the religious sentiment.

PHYSICAL FEAR-FORCES.

The external nerves of sensation in the body are a means of protection to life. Their existence is otherwise unnecessary, since it is pain and rarely pleasure which they afford. The nerves which are the seat of bodily pleasure are chiefly internal, and never come into contact with external objects, at least except when purposely introduced, as food to the palate, etc. The ether-waves which strike the retina and the air-waves which reach the tympanum produce no sensation of which the mind is conscious. If they ever chance to do so, it is a painful one. The tongue and palate are indifferent to the resisting qualities of food, or certainly derive no pleasure from them. The sensation produced upon them is a *molecular* one, caused by chemical action, and is never experienced when insoluble substances are applied. The pleasure of sexual contact is of a wholly different nature from simple sensation. The emotional pleasures are seated deep in the body, and know no objective contact, while the brain can only communicate to the external world by means of its system of nerves. Neither is it, in the nature of things, necessary that nerves of pleasure should possess sensitiveness to contact, as is proved by the fact that even the nerves of sense may be severed at their origin without producing pain. It would seem certain, therefore, that the true function of the external nerves of sensation is that of sentinels to avert danger and protect the body from harm and destruction.* It requires no assumption of an intelligent design for those who object to such an interpretation to account for their existence. The law of natural selection is sufficient, since any species destitute of this power of premonition would soon be extinguished.

The pleasure afforded by any form of external contact is utterly insignificant in comparison with the pain which is being perpetually experienced from the same cause, and it is this immediate pain, more than the subsequent enfeeblement, death, or extinction, that forms the object of fear. Just as in all the great necessary vital acts, it is not the preservation or perpetuation of existence, but the temporary pleasure afforded by the act of which these are the necessary consequences, which is sought, and which is alone sufficient to move the action, so, in the case before us, it is not the ultimate consequences of external injury, but the immediate pain incident to violent contact, which is sufficient to arouse the body to the action necessary to escape it. This sentiment is fear, and in this form it reaches down to embrace the greater part of all sentient beings. In man it is nourished and sharpened by experience, by reason, and by precept, until it embraces dangers far beyond the scope of the senses. As results of the fear of *want*, might have been treated all the great social and economic labors which man has performed in his career, and which were considered under the preservative forces. There remain two other sources of fear, viz., fear of *violence* and fear of *disease*, which it is proper to consider here.

* The important general bearings of this fact, which were touched upon in the Introduction, will be fully drawn out in Chapter IX.

Fear of Violence.—There are two forms of violence which have been feared by man, and his efforts to escape which have produced important social and moral results. He may be regarded as having always had two classes of enemies against which he must perpetually contend, and of which he has always stood in awe. Both animate and inanimate nature have appeared to assume a hostile attitude toward man.*

Fear of Man.—The animate being which has most seriously obstructed man's progress has been man himself (*supra*, p. 463), and the precautions taken and acts performed to protect himself from his own kind are among the most extensive of human operations. Fears from this source have usually been well founded, and the precautions taken necessary. For, while war must be admitted to be a terrible blight upon civilization, it is vain to talk of abolishing it so long as its spirit rankles in the human breast. The principle of non-combativeness, which may succeed in small wandering sects, would be the degradation and extinction of nationalities. In other words, non-resistance would be fatal. The reform must be on the side of the offensive, and not on that of the defensive. If war is ever done away, it will be when the spirit of aggression, not of protection, shall have been quenched. This is one of the radical errors of peace-reformers: that of supposing that peace can be maintained except by the very threat of war, so long as the war-spirit prevails in any considerable portion of mankind.†

Fear of Animals.—Man's dread of violence from the animals below him has formed a great part of his solicitude, and occupied a large share of his attention. He came upon the globe as one of them, possessing no divine charter of mastery or supremacy. He entered the lists in the struggle for

* "Es liegt tief in der trüben Natur des Menschen, in einer ernsterfüllten Ansicht der Dinge, dass das Unerwartete, Ausserordentliche nur Furcht, nie Freude oder Hoffnung, erregt."—(Humboldt's "Kosmos," Bd. i, S. 75.)

† Fénélon, "Télémaque," liv. xiv.

existence and survival as an equal competitor. Looking out from the advanced position which he now occupies, the odds seem vastly in his favor. But it was not always so. It is in the prehistoric epoch that the greatest struggles must have taken place.

The fear of wild animals, serpents, and dangerous insects is still very great in all sparsely-peopled regions, whether the inhabitants be native savages, or colonists from civilized countries, and many are the hardships from this source to the pioneer settlers of every new country.*

But the danger is apt to be imaginary, and the fears that were once justly entertained are perpetuated long after the cause has disappeared. Ignorant of the distinctions which should be made, it is common for even the most cultivated people to experience a dread of nearly every living thing. The most harmless animals are feared, and dangerous habits and qualities attributed to creatures which may really be the best friends of man. There exists an especial terror of reptiles, insects, and vermin. All snakes are supposed to possess deadly fangs, all insects poisonous stings, and all worms, including innocent larvæ which are supposed to be worms, a venomous bite.† Children are imbued in their infancy with a thousand vague, fanciful fears of danger from beasts which no longer exist, except in remote wildernesses, where they justly fear and fly before man. An immense amount of artificial, groundless, and imaginary fear is thus manufactured and thrown in upon society to consume its nerve-force, and

* According to official returns, the number of persons who died from snake-bite in the Northwest Provinces and Oudh (India) during 1879 was 3,168. Besides this, 1,051 persons were reported to have been killed by wolves and leopards during the same period. A partial explanation of this state of things, however, may be found in the facts set forth in Chapter X (vol. ii, p. 271).

† Most wild plants are assumed to be poisonous unless well known. A party engaged on one of our geographical surveys of the Territories once found a very pleasant-flavored wild-cherry, which they observed was never touched by the Indians. On inquiry, they learned that these regarded it as poisonous, and no one had ever been known to taste it! The coarse names which most plants received from the early herbalists also proves the dread in which they were held.

render the race cowardly and effeminate. It is one of the most active agencies of social degeneracy, and a powerful element of that system of false conceptions which in time completely permeate a civilization and render it effete.

The remedy for these pernicious imaginary fears can, of course, only be a correct education. A positive knowledge of what things are dangerous and what innocent, and the disabuse, in children, of all absurd notions productive of fright, are all that would be required to rid society of this one of its most useless nightmares.

Fear of Inanimate Nature.—Fear of inanimate nature is scarcely less profound and universal than fear of animate nature. Every visible phenomenon or effect in the world of matter has, at one time or another, been regarded with awe and dread. The winds, the storms, the waves, the floods, the earthquakes, the thunder-bolts, the fires, etc., that ever and anon sweep over the earth—all these and many more of the physical phenomena have, in varying degrees at divers times, inspired the human soul with the most profound awe and terror. The vague and baseless fears which all ignorant races entertain for these things have had their origin in real danger. But the hidden character of such dangers, and especially the unseen source of power manifested in the inanimate world, has had the effect to arouse in their crude minds a train of imaginary terrors far more extensive than the real danger. Himself an animal, man has animated the whole universe and endowed every movement in nature with vitality, purpose, and will. This fetichism, which is the first form of religion, is the first step toward the conception of a deity. *Primos in orbe deos fecit timor.* How can motion exist without a mover? is the first problem in theology; and every savage tribe of men that has ever emerged from the condition of brutes has propounded to itself this problem and given to it the same answer, has based upon it the primary thesis of theology—the existence of deity (vol. ii, pp. 262, 268).

Man has often sought to bridge over the chasm between the animate and the inanimate world by endowing physical objects with life, and, throughout every system of mythology, religion, or philosophy, that has come down from pre-scientific ages, the mysteries of physical agency have been blended and interwoven with those of vital agency on the one hand and with divine agency on the other.

Fear of inanimate nature is the foundation of superstition, and the heroic efforts of a few to overthrow it have led the world into the path of science. I need only allude to the vast social results toward which these two great tendencies point. The wretched demoralization of superstitious fear can only be offset by the light and freedom of scientific hope.

Fear of Spiritual Beings.—The fear of spiritual beings is simply a last consequence of the tendency to impersonate natural objects. Not content with making fetiches, idols, and gods of objects which have a real existence, men have conjured out of fancy and peopled all space with myriads of spiritual beings, which they have feared, worshiped, implored, and propitiated under a variety of names. Harpies and griffins, sylphs, satyrs, and undines, ghosts and hobgoblins, have each haunted its appropriate spot, and inspired the superstitious world with a thousand terrors throughout all ages. These imaginary fears have exerted their legitimate influence upon human society, and put their indelible stamp upon the civilization of each age.

Fear of Disease.—Along with these fears of personal violence, whether real or imaginary, and whether proceeding from animate, inanimate, or supernatural sources, there has existed a deep-seated dread of bodily *disease*, which, while it has been less apparent in its outward character, has, nevertheless, affected the constitution of society in a no less profound degree. Totally ignorant of the mechanism of the physical body, and particularly of its internal organs, and wholly unconscious of the nature of the vital functions and the external elements of supply; finding themselves a constant prey to innumerable disorders, and beholding their kindred swept away daily by the mysterious hand of disease, it was natural for the imagination of primitive men to run to the wildest extremes, and the fancy to indulge in the most absurd speculations as to the cause of so terrible and insidious a scourge. Just as the tendency was to impersonate all inanimate sources of violence, and bring them under one explanation, so the tendency was further to impersonate the sources of disease, attribute it to some form of violence and to some voluntary agency, and thus to reduce it to the same explanation. This accounts for the fact, at first view so singular, that so many of the savage races of men believe that no one ever dies, but is killed, and ascribe every death which we call "natural" to the successful malice of some personal enemy, either dead or living.* The delusion known as witchcraft, recognized in the Hebrew statutes,† and by the Twelve Tables of Roman law,‡ but reaching its most alarming state under the Christian dispensation, where, for three centuries, it raged over Europe, and even took root on American soil, and which counts its victims by millions, was nothing less than the legitimate operation of this same belief, the greater part of the alleged bewitching being cases of attacks by disease.

Like every great source of fear and dread demanding relief and protection, the universal fear of disease brought to the foreground a large corps of individuals who pretended to be able to supply the needed remedies. These were primarily pure superstitions, and consisted in mere ceremonies, either with or without the application of some assumed remedial substance.# As the world grew more rational, the ceremonial part gave way to the remedial, and the investiga-

* Sir John Lubbock, "Origin of Civilization," pp. 132, 133; Spencer, "Principles of Sociology," vol. i, p. 250.

† Exodus, xxii, 18; Deuteronomy, xviii, 10; 1 Samuel, xv, 23.

‡ Tabula viii, Fragment 25.

The pure form of exorcism, without remedial application, prevails at the present day among most savage tribes.

tion of nature for the purpose of finding remedial agents for diseases became an occupation for many. The study of plants and mineral substances for this purpose, while it resulted in the discovery of many useful medicinal and dietetic properties, performed the greater service of paving the way to a systematic acquaintance with these two great kingdoms of nature.* To realize how extensive must have been this research before the science of botany was known, one has only to run over the popular names of plants, and note how large a proportion of them are derived from some imaginary healing power possessed by them. From this same source, too, has sprung the whole science of medicine, with its vast *materia medica* and extensive acquaintance with diseases. The sciences of anatomy, of physiology, of hygiene, and even of chemistry and physics, owe their impetus and the greater part of the fundamental facts upon which they rest to the indefatigable labors of Hippocrates, Dioscorides, and their successors.

But, although the great laws of animal economy have been so thoroughly probed, the anatomy and physiology of the body made known, and the chemistry and physics of the vital functions explained, the mysteries of disease and the remedies for physical disorders are not yet by any means all reduced to practical recognition. The fear of sickness still exists, and bears its heavy weight upon society. No longer, it is true, do we see the spectacle of the dead-cart collecting the bodies of the victims of the "Black-death" from door to door, while the belfries of the churches are ringing propitiatory chimes in invocation of divine relief, which could have been secured by men had they taken the precaution to cleanse their streets and remove the deadly gases which were doing the horrid work, but which because invisible were unknown. Priestley and Lavoisier have banished such scenes

* There can be no doubt either that the science of anatomy received a strong impetus from the ancient rite of haruspicy. (See Auguste Comte, "Philosophie Positive," vol. v, p. 96.)

for ever from the civilized world. And yet these subtile agencies are every-where at work, and it is rare that a life is capable of running their gantlet and succumbing only to the natural laws of dissolution. Science has here its greatest work yet to do, its greatest victory to achieve. The masses are unpardonably ignorant of the truths which are known to the few. Society's first great duty is to universalize and popularize all the knowledge in existence which bears upon the problem of health.

Subjection to a faculty of medical experts is dangerous in a variety of ways. There is danger of co-operative monopoly for gain, of charlatanism, of narrow dogmatism, and of reckless experimentation. In the present state of society, the dread of disease is only equaled by the credulity and servility of the masses, and of the abject dependence of even the best informed people in other respects upon the so-called "guardians of the public health." Many, who ought to know, never stop to reflect that the functions of the animal economy never should be entirely intrusted to any guardian but themselves, that life consists of certain processes requiring certain nourishment and certain measures of protection, without which its functions can not go on regularly, and which all that the highest medical art can do is to supply. They seem to believe that these processes can be arrested and these supplies denied for an indefinite time if only the magic wand of the physician is stretched out at stated intervals to administer relief. This superstition is only equaled by that of the laity who ascribe to their priests the power of pardoning all their short-comings at stated intervals and for fixed sums of money; and the influence of the former upon the health of the victims is exactly comparable to that of the latter upon their morals. It is to the interest of the sanitary priesthood to perpetuate this fear, this belief, and this ignorance, just as much as it is of the religious priesthood to perpetuate the other. Society is suffering from these practices, and its duty to itself is to educate all its members in a sound and rational knowledge of themselves, so that each may be the guardian of his own health. There will still remain an ample field, as already shown, for the true votaries of sanitary science, for medical and surgical experts.

PSYCHICAL FEAR-FORCES.

There only remain to be considered the psychical fear-forces, or those fears and hopes which men experience of harm or of good to their supposed immaterial part, the soul.

As already remarked, these are all of a religious nature, and it may be added that, while the most extensive of the religions of the world seem to give play to them, the doctrine of some form of future existence, capable of experiencing pain and pleasure, is by no means common to all religions (vol. ii, pp. 253, 261, 280). The Hebrew religion is a notable exception, while in Buddhism the only trace of it is in the doctrine of metempsychosis. It is a distinct element of the Egyptian, Persian, and Grecian mythologies, and has been crystallized into a cardinal principle of Mohammedanism and Christianity. The importance of this class of forces as modifiers of social conditions consists in the powerful hold which such a doctrine takes upon the receiver of it. There is something absorbing in the idea of a future state of existence, and especially when that state is believed to be an endless one. It would seem as though the great natural objects of preservation and perpetuation of existence were cemented into one, and brought into the full recognition of the intellect. Even this is heightened by the additional conception that personal identity, consciousness, and memory of former states are to be embraced in the future life. For, without these, what better is a future existence than the existence of other beings at a future time? Without the persistence of memory, it is no longer a perpetuity; it is only another and distinct existence, another and separate being. This is accomplished by reproduction, and nature strains every nerve to secure it. But it is not enough. The rational mind soon rises to the conception of continued existence, soon sighs for a persistence of itself, an uninterrupted and unlimited existence. Even the Hebrew asked the vital question, which went ringing down through the corridors of Judaic ages, "If a man die, shall he live again?" * till at length the answer burst from the lips of Jesus, and was caught up by those of Mohammed and carried like wild-fire to the ends of the earth. So talismanic was the word *immortality* that it took the whole world captive, and to-day claims as its adherents all but the most barbarous races and the inhabitants of Eastern Asia, who have themselves been considerably modified by it.

Much of the success of the doctrine of immortality has been due to its dualistic character. With true anthropomorphic conceptions, its teachers have employed it as a means of government, and have made it the sanction to their code of action. In other words, this future existence has always been represented as a means both of reward and punishment. Those who were not charmed into its adoption by hopes of eternal happiness were frightened into it by fears of eternal misery. And thus, like a two-edged sword, it mowed its way to almost universal acceptance.

But the task before us now is simply to point out the effects which have been produced upon society by hopes and fears entertained of benefits and injuries to the soul in a future state. The true method of determining these, even approximately, would seem to be to figure to ourselves what would have been the probable condition of society in countries where this belief prevails if it had never been introduced. This is by no means an impossible supposition, and the only good objection to this method of inquiry is the difficulty in answering this question. But, if we confine ourselves to Christianity and Mohammedanism, we find that they have been grafted upon other forms, which they have ultimately completely supplanted. And, since it is an historical fact that the moral conceptions of a religion must correspond with the

* Job, xiv, 14.

people who embrace it, or at least that the two will be sure to find a sort of common level, reached by reciprocal modification of tenets on the one hand and customs on the other, there is no impossibility involved in the assumption that the religion supplanted might have continued to the present day, had it not been suppressed by a stronger rival faith. Assuming this much, we can form some idea of what Europe and Eastern Asia might have been but for the intervention of Christianity and Mohammedanism. Two great religions were crushed out by the advent of these new rivals, viz., Grecian polytheism and Persian Parseeism. Both these embodied the doctrine of immortality; but it existed in so feeble a state as to take little hold upon the masses. Grecian polytheism had made great progress in Asia, and was almost as powerful even in Persia as was the dualism of Zoroaster. Without speculating upon the influence of Christianity, and later, of Mohammedanism, in Asia, where the people were less enlightened, and where the form of religion, probably, did little either to elevate or degrade them, we will turn our attention to Europe, where, especially in Greece and Italy, literature and the arts were in a high state of cultivation. The question then is, In what respect would the civilization of Europe be different from what it is to-day had the Grecian polytheism remained unmolested by Christianity and all other forms of faith?

Greece and Rome maintained toward the national religion an attitude quite analogous to that which Germany, France, Great Britain, and America present now toward Christianity. The masses believed and went through the ceremonies, while the philosophers and school-men stood aloof and remained indifferent to religion, appearing to consider it beneath their notice, just as now the rank and file observe the forms of the Church, while the most cultivated, and notably those engaged in scientific investigation, are for the most part indifferent to religion, and do not feel called upon to devote any time from their pursuits to its consideration.

There were indications, then, that the bonds of religious restraint were about to fall from the people, and the light of knowledge be admitted to all, just as now we see the forms of religion more and more ignored, and education further and further extended. But Christianity rekindled the religious zeal, proscribed philosophy, abolished the schools, and plunged the world into an abyss of darkness from which it only emerged after twelve hundred years. Ignorant of what would have happened if this had not happened, nothing is left but to regard the advent of Christianity as a calamity.* And, if we look at the history of Christianity, we find that its activities have been so intense and its deeds so violent that it has been almost impossible for thought to obtain a foot-hold. Mohammedanism was no better, but its field of operations has been less unfortunate.

The intensity of these religions must be attributed to that doctrine which is their cardinal principle and their source of vitality—the doctrine of immortality. There can be no doubt that this doctrine has exerted an exceedingly pernicious influence upon the progress of thought, of knowledge, of material civilization. And, if we look at it from a moral point of view, we see little to recommend it there. It makes light of the present, contemns the real and the material, and feeds the mind on vague imaginings. The hope of personal pleasure and fear of personal pain are sentiments which are not less mean and sordid because that pleasure and pain are

* It is fashionable in Protestant countries to ascribe these acts of violence, now so universally understood, to the "Roman Church" (see Draper's "Conflict," p. x), or to charge their commission upon the "Catholics." This course seems very improper where reference is made to the period anterior to the Protestant Reformation, since the terms "Roman" and "Catholic" are chiefly employed to distinguish that sect from the Protestant sect. The history of the Roman Church prior to that epoch is essentially the history of Christianity, and its acts must be regarded as the normal operations of the Christian religion. To attribute them to Catholicism, in this special sense, besides being misleading and historically inaccurate, is otherwise objectionable in suggesting a desire to pander to the locally prevalent sectarian feeling or to avoid offending it by such a use of the word "Christianity."

to be experienced in a future existence, and upon the immaterial part. Upon a thorough consideration of the subject, we must conclude with Mr. E. B. Tylor * that belief in a future state of rewards and punishments exerts a powerful demoralizing influence.

But, although the influence of the psychical fear-forces has been generally bad, we can not shut our eyes to its importance. The doctrine of immortality has modified the character of society, of human institutions, and of civilization, to an extent which can never be exactly calculated, and it is not liable to be overrated. It has intensified religious feeling, and enormously magnified the results which flow from it. The moral elements which accompany religion can not justly be embraced in the consequences of religion itself. They exist independently of religion, and their connection with it is only apparent. Religion never fails to appeal to the moral sentiments which it finds prevalent, and to claim credit for them as its own, but the history of morals shows that this claim is wholly unfounded (vol. ii, pp. 279, 280, 283).

The true influence of religion must be based upon the legitimate effects of its doctrinary teachings, upon the influence which its beliefs exert upon human conduct, upon the difference between the general state of society, as entertaining such beliefs, and what it would be did it not entertain them. And the comparative merits of different religions must rest upon the same principle. Thus considered, the comparison of those faiths which embody as their central doctrine the belief in a future state of rewards and punishments with those which embody no such doctrine, or which do not make this their leading doctrine, becomes less difficult, and we find, as already shown, that the former have been far more active, far more intense, and have, consequently, exerted the legitimate influence of all religion to a far higher degree.

* "Primitive Culture," Boston, 1874, vol. i, p. 495; vol. ii, pp. 104, 106.

It may no doubt be truly said that the influence of this faith has not been an unmixed evil in society. It is true that the history of the Christian and Moslem faiths, agreeing in this one vital character, has been one of dark and bloody deeds, of persistent hostility to all forms of true enlightenment, and to that extent of general injury to human interests; but it may be frankly confessed that the hope and anticipations of so many individuals, which are certainly pleasurable emotions, constitute no mean item which must be legitimately placed to the credit of the belief in immortality. Although a purely egotistic sentiment of a very low order, still, as a real pleasure, it should not be overlooked. True, there may be question whether the amount of unhappiness caused by the fear of endless suffering may not equal the amount of happiness resulting from the hope of endless bliss. Still, there remains the fact that a positive gratification and a form of happiness have always attended the belief in a future existence. Whether, upon the whole, the aggregate amount of human happiness would be greater, *ceteris paribus*, with than without this belief, it is impossible to judge. I incline to agree with M. Auguste Comte and Mr. Tylor,* that its legitimate moral influence on mankind has been greatly exaggerated. But, however this may be, it is at least certainly true that this effect, whatever its extent, has been altogether of a *statical* character, never of a *dynamical* one (vol. ii, p. 265). If it makes men happier, it does not make them wiser or more energetic; in fact, except in the work of repressing the progress already attained, its influence has constantly been to dampen man's ardor for the conquest of physical nature, by which alone all true progress has been accomplished. It has tended to belittle the importance of the present state, and deny the dignity of material things, while the energies and activities, both of mind and body, have been thus withdrawn from progressive and

* "Philosophic Positive," vol. v, pp. 123, 124, 297, 299, 300; "Primitive Culture," Boston, 1874, vol. ii, pp. 104, 107.

productive labor, and wasted in beatific contemplations and bodily mortifications. Thus, in a twofold manner, has this belief operated against the true advancement of the race.

Social progress results almost exclusively from calm, rational action. Fear and hope, not being essential forces, must be very moderate not to disturb the proper conditions of advancement. Any wide-spread belief which calls out these sentiments to an extreme degree is therefore highly prejudicial to social interests. The psychical fear-forces operate in this direction, and are therefore, upon the whole, injurious. Applied sociology will seek the means of subduing them, by allaying all groundless fears and encouraging only the most rational forms of hope.

III. The Intellectual Forces.

Properly to treat the intellectual forces as a separate subject of inquiry would require another distinct chapter, and might easily be extended into a volume. The operations of the human mind, however, form the chief subject of this work, and not only the results of these operations, but the conditions, laws, and constitution of the mind itself, have been treated of under their appropriate heads (*supra*, Chap. V). Nothing remains, therefore, but to embody all this under a general view of the social forces, and assign to the intellectual forces their proper place in the enumeration.

It scarcely need be repeated that it is to the activity and intensity of the intellectual forces that the human race owes all its superiority over other species of animals, and deserves, more than they, to be made the subject of historical and scientific investigation. Mental superiority is the condition upon which all the results arrived at depend. Given a certain degree of intellectual force, and the dynamic laws of animal life will evolve definite results. Mind is the variable, the other forces the constants. Put the former equal to zero, and we have stagnation. Give it a series of increments, and we have a series of results corresponding to these increments.

In animals, the mind-force is low, and progress is correspondingly slow. In man, it presents a series, and we find degrees of social development and elevation proportionate to the increment as we rise from the lowest to the highest of the human races. The ratio of increase is an accelerated one, owing to the mutual effect of subjective and objective development.

There is only one phase of this subject which can be regarded as in any sense belonging to this discussion. It is only the direct effects which flow from the activities engendered by intellectual desires and enjoyments, the same as it was shown to be only those which flow from the activities engendered by æsthetic and emotional desires and enjoyments, which can properly be regarded as dynamic forces of society. The mind-force, as popularly understood, is no force, but only a *condition*. It does not propel, it only directs. It is not mind, except within the narrow limits of this definition, that achieves the vast results which civilization presents, and which, it must be admitted, could not be achieved without it. It is the great social forces which we have been passing in review that have accomplished all this. Mind simply guides them in their course. The office of mind is to direct society into unobstructed channels, to enable these forces to continue in free play, to prevent them from being neutralized by collision with obstacles in their path. In a word, mind has for its function in civilization to preserve the dynamic and prevent the statical condition of the social forces, to prevent the restoration of equilibrium between the social forces and the natural forces operating outside of them. Just as it is not psychological force which propels the water-wheel or the piston—which could not, nevertheless, be made to operate without it—but merely the forces of gravity and gaseous expansion compelled by mechanical power under the guidance of intelligence to operate for the benefit of man, so it is not mind which moves the civilization of the world, but only the great and never-ceasing forces of society, which but for the guidance of mind would rush blindly on into a thousand entanglements with rival forces, and assume that position of statical equilibrium which represents social stagnation. The only proper intellectual propelling force in society is the desire which the mental organ experiences in common with all the rest to act, and the immediate results which flow from its activity.

The love of acquiring knowledge, however, and the pleasure derived from intellectual activity, and particularly from that form of activity which follows the recognition of truth, have been important elements in the development of human institutions. They have been strong enough to overcome the tendency to inertia after all the physical wants were supplied, and to impel men on to the discovery of truth from the mere enjoyment which its investigation yields. While it is true that most of man's triumphs over nature have been achieved in obedience to the grosser forces, either of necessity or of passion, the fact must not be overlooked that the most profound and long-protracted researches that have been conducted, and the most important and practical discoveries that have been made, have emanated from those who could have been moved to perform this great service for humanity neither by want nor avarice, and to whom the charge of ambition would be scarcely applicable. I need only mention two of the many immortal exemplifications of this truth, Newton and Humboldt. With them as with so many others, the chief and ruling motive to their useful activities could have been little else than the ennobling pleasure which never fails to attend the highest and purest exercise of the intellectual functions. The world has nothing to fear from the relief of cultivated brain from the cares and wants of vegetative existence.

Concluding Remarks.

In the foregoing consideration of the phenomena and laws of tertiary aggregation, those of the dynamic group have been chiefly reviewed. This course has been adopted for a variety of reasons, the principal of which is that what is here said is designed rather as an introduction to the argumentative part of this work, to be embraced in the second volume, where the term DYNAMIC SOCIOLOGY will be more fully explained, and the conditions of its realization considered. The notion intended to be conveyed by that expression is not complete until the active stage is reached, which, as explained in the INTRODUCTION, is simply the "applied" stage of the science of Sociology.

Among the other reasons for omitting the statical department may be mentioned the somewhat hackneyed character which it has already assumed. For, although the dynamic laws of society can only be expounded from empirical data of a statical nature, and although I deprecate as deeply as any one the attempt to speculate upon this most complex of all sciences without a basis of facts, still I do not hesitate to pronounce as mere superficial patchwork the greater part of all that now goes by the sounding name of "social science."

There is, indeed, ample room for true scientific work in the field of social statics, but most of the would-be laborers in this field have greatly mistaken the nature of the science itself. They are apt to imagine that a large and unorganized mass of facts skimmed from the very surface of social phenomena, belonging, some of them to government, some to political economics, some to the industrial, commercial, and financial departments of the most forward and derivative civilizations, promiscuously mingled together in a common *mélange*, and labeled "social science," is really science, when it is not deserving of that dignity.

I have no ambition to identify myself with this class, while I humbly confess myself unqualified, through lack of opportunity, if not otherwise, to undertake any substantial contributions to the much-needed data of Sociology. That truly heroic production of Mr. Herbert Spencer and his able assistants, his "Descriptive Sociology," is undoubtedly a genuine example of the nature of the work required in this department; while the many sterling contributions made by Tylor, Lubbock, Maine, Morgan, Powell, Bancroft, and other ethnographers and historians of the anthropological school, demonstrate that in sociology, as in every other science, the accumulation of details is in advance of their coordination into laws and principles. The present demand is, therefore, for synthetic treatment, by which alone the materials of any science can be utilized. In these pages it has been strenuously sought to lay down no principle which is not warranted by the facts already accumulated. Any thing further than this has simply been thrown out by way of suggestion, as a clew to further methods of investigation, to stand or fall with the evidence to be adduced.

It has therefore been the *movement* rather than the *status* of society, which it has been sought to explain, the causes of social phenomena and social progress rather than the condition of society itself.

The status, or condition, of society is to be learned by the consideration of the *indirect*, or *functional*, effects of what have been denominated the social forces. The study of the indirect effect of the preservative forces of society would lead to an acquaintance with the nature of the objects which have been employed by man as means of subsistence—a subject only touched upon in this chapter because, if legitimate, manifestly too large for the limits of the work.

The consideration of the indirect, or functional, results of the reproductive forces would lead to a discussion of the most important of all social institutions, the family—a subject which has already been ably treated by many writers.

Still less could we afford to attempt a survey of the wide field of æsthetic art, the deep currents of human morals, or the intellectual condition of mankind in past ages, as would be required by a consideration of the indirect effects of the non-essential forces. These indirect, or consequential, results constitute what I have called the *objects of nature*, for securing which the desires and passions of men have been developed by the law of natural selection. As already remarked, they have no necessary or real connection with the *object of man*, which is to *enjoy*, and the harmony between the two can only be accounted for, as stated, by adaptation and survival of the fit, or by divine guidance and final causes. That it is explicable by the former renders resort to the latter a violation of a now well-established canon of science.

Although these objects of nature are the true cause and only valid *raison d'être* of the social forces, it is nevertheless true that these indirect statical effects exert no influence in changing the condition of society, or in effecting its advancement to higher states. They only preserve and continue it. The social forces, in thus indirectly producing these functional results, do not operate in the normal way in which all true forces operate. Although the true ends of biological not less than of sociological organization, these results are really only the incidental workings of these forces accomplished by virtue of a higher law which has slowly adapted all living beings to this end. Quite independently of these incidental consequences, and not in the least diminished or increased by reason of them, these social forces are constantly producing at the same time their normal and legitimate influence upon the environment, their natural direct effects as true forces of nature. It is these to which we have confined our inquiries, because it is these alone which tend to accomplish the objects of man and of society, and these alone which tend to produce change, and hence progress, in the world.

In many respects tertiary aggregates resemble secondary aggregrates. A large proportion of the laws of biology apply equally to sociology. An aggregation of these highest biological units bears, in many general ways, a striking resemblance to an aggregation of the highest morphological units. But, besides the necessarily discrete character of the former, and besides many other of the distinctions which Mr.

Spencer admits, there is one which he seems to have overlooked, but which appears to be wider than any of the rest.

By no possibility can any higher order of integration mechanically take place in the biological units. We may classify the various organisms into numerous more and more general groups until we reach a logical unit embracing all life. But this has no mechanical influence on the forms themselves; the individuals maintain their integrity and their natural independence, unaffected by man's intellectual generalizations.

The various social organisms, on the contrary, by virtue of the very fact that the sociological units are discrete, may coalesce, re-form, expand their allegiance, and enlarge indefinitely their own dimensions. This process of expansion and re-integration has actually gone very far, and there is already a feeble union existing among all the societies on the globe, and quite a strong one among all the civilized societies. The eventual complete integration of all the inhabitants on the globe into one dependent whole, commercially at least, if not politically, is no idle chimera. This union is not a mere logical classification, but a true mechanical solidarity, already far advanced and still advancing.

Still another important distinction between tertiary and secondary aggregates, also growing out of the discrete nature of the units of the former, is found in their mode of dissolution. Societies do not properly die. They disappear, it is true, but this disappearance is not a true demise. In the great majority of cases they become transformed through migration. The *élite* of societies one by one abandon the seat of their former activities and continue them in new centers. Old centers thus appear to decay, and new ones to spring into life. Not to speak of the *Pergama recidiva* through the fabled migration of the *reliquiæ Danaûm*, we have reliable history for many such transmigrations. Italy has seen a near approach to it again, and Greece has been the unhappy victim of it. Central and Northern Europe has been the recipient of the sinew of more southern and eastern societies, and America is rising to the first rank by virtue of the same process. And what is the Teutonic civilization of to-day but the Brahmanic civilization of the age of Menu transplanted to European soil? It is simply this godlike Brahmanic caste, the Aryan or Indo-Germanic race, now occupying the coasts of the Atlantic instead of those of the Indian Ocean, which still dictates knowledge to the world.

But societies often appear to relapse from other causes than the actual withdrawal and migration of the *élite* of their members. There is a process which may be called *dilution*, that frequently takes place. This happens in two distinct ways: 1, by influx of less advanced populations in great numbers; and, 2, by the natural operation of the Malthusian law (*supra*, p. 66). The barbarian invasion of Rome and the Ottoman occupancy of Western Asia and Southeastern Europe are historical examples of the first of these modes of social dilution; while a possible Mongolian influx into Western America may one day constitute a still more fatal case of the same kind in the New World.

With regard to the second mode of social dilution, viz., by the natural operation of the Malthusian law of population, it may be remarked that all societies are at all times liable to it. So long as the population within a given territory is increasing, waves of social reaction may occur at any time. Every one has observed the profound influence exerted by what are called periods of "hard times." And these are frequently caused in great part by these economic social laws. It is not necessary that the amount of production shall fall short, and that the means of subsistence shall fail to keep pace with the increase of population. The Malthusian principle is far broader than its able expounder supposed. Just as Mr. Darwin has been able to apply it to the whole animal world below man, so it is also capable of being applied to supra-economic questions in society. Modern society, in the most civilized countries, is so highly derivative, and rests to so great an extent upon ideal conceptions, that an exceedingly high state of popular intelligence must be constantly kept up to prevent rude tampering with the delicate machinery by which its operations are conducted. Each new individual that is added to its membership must be schooled from the beginning in the principles upon which the social fabric is constructed. He enters it wholly ignorant of them all. The civilized infant is as blank intellectually as the savage infant, and has no longer to live, and immensely more to learn. Each one must be instructed in all this complicated curriculum *ab initio*, before he can conceive of his true relations to society. We may therefore say in this connection, as truly as Malthus could say of his economic formula, that, while in the progress of civilization the capacity to acquire knowledge increases only in an arithmetical or some lower ratio, the amount of knowledge necessary to be acquired increases in a geometrical or some higher ratio.

It is in view of this law that there constantly exists so great danger in highly advanced societies of a relapse, or at best a temporary reaction, seriously prejudicial to their interests and painful to their highly sensitive condition. A financial blunder, under such circumstances, may paralyze industry and profoundly influence the entire social fabric at a time when there is an abundant supply of food and all other commodities. A vicious system of dispensing the public domain may render millions penniless, and jeopardize the stability of a nation. Bad legislation of all kinds is sorely felt by the masses, irrespective of the power of the people to increase the aggregate wealth. Large monopolies, tolerated by the central governing authority, are capable of doing unlimited mischief. And, finally, we have seen, in the latest period of depression, an example of how evil can accrue on a vast scale by a long period of abundant but ill-adjusted production.

All this proves that the great necessity is the maintenance of a standard of intelligence corresponding to the degree of civilization, and that, to secure such a correspondence, intelligence must increase at a much more rapid rate than does material and social organization. And this is why I insist that the time must soon come when the control of blind natural forces in society must give way to that of human foresight, or the highest civilizations of the earth must reach their culminating point and commence their decline. Nothing can prevent the occasional recurrence of states of social depression, under such conditions, but progress in intelligence, and practical science corresponding to the increase of numbers and social refinements. And a time must certainly come when the maintenance of the healthy and progressive tone of society will be far more difficult than at present, or at any period of the past. Thus far, social progress has in a certain awkward manner taken care of itself, but in the near future it will have to be cared for. To do this and maintain the dynamic condition against all the hostile forces which thicken with every new advance, is the real problem of Sociology considered as an applied science.

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